ANSWERS

TRIGONOMETRY WITH TABLES

1954 and 1957 Editions

CURRICULUM

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W. R. KRICKENBERGER

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ANSWERS

Page 9

2. equal; in proportion.
3. 62.4 ft.
4. 28.6 ft.
5. 96°; 162 ft; 100 ft.
6. $\angle A = 51°$; $\angle C = 39°$.

Pages 20-21

1. 0.6; 0.8; 0.5; 0.9; 0.5; 0.8; 0.9
2. 0.8; 0.6; 0.9; 0.5; 0.8; 0.5; 0.9
3. 0.8; 1.3; 0.5; 2; 0.6; 1.7; 1.9
4. 1.3; 0.8; 2; 0.5; 1.7; 0.6; 1.9
5. 1.2; 1.7; 1.1; 2.2; 1.2; 2; 2.1
6. 1.7; 1.2; 2.2; 1.1; 2; 1.2; 2.1
7. 0.4; 0.4; 0.7; 0.7; 0.6; 0.6
8. 0.4; 0.4; 1; 1; 0.8; 0.8
9. 0.8; 1.5; 0.7; 0.6; 1.7; 0.5; 0.9
10. 0.7; 0.6; 0.7; 0.5; 0.6; 1.7

11. a. $\sin A = \frac{DC}{AC}$ $\cos A = \frac{AD}{AC}$ $\tan A = \frac{CD}{AD}$ $\csc A = \frac{AC}{DC}$ $\sec A = \frac{AC}{AD}$ $\operatorname{ctn} A = \frac{AD}{CD}$

b. $\sin A = \frac{BC}{AB}$ $\cos A = \frac{AC}{AB}$ $\tan A = \frac{BC}{AC}$ $\csc A = \frac{AB}{BC}$ $\sec A = \frac{AB}{AC}$ $\operatorname{ctn} A = \frac{AC}{BC}$

c. $\sin B = \frac{CD}{BC}$ $\cos B = \frac{DB}{BC}$ $\tan B = \frac{CD}{DB}$ $\csc B = \frac{BC}{CD}$ $\sec B = \frac{BC}{DB}$ $\operatorname{ctn} B = \frac{DB}{CD}$

Page 24

	sin	cos	tan	csc	sec	ctn
1. 30°	0.50	0.87	0.58	2.0	1.1	1.7
2. 45°	0.71	0.71	1.0	1.4	1.4	1.0
3. 60°	0.87	0.50	1.7	1.2	2.0	0.58
4. 75°	0.96	0.26	3.7	1.0	3.9	0.27

544998

	sin	cos	tan	csc	sec	ctn
5. 20°	0.34	0.94	0.36	2.9	1.1	2.7
6. 25°	0.42	0.91	0.47	2.4	1.1	2.1
7. 50°	0.77	0.64	1.2	1.3	1.6	0.84
8. 68°	0.93	0.37	2.5	1.1	2.7	0.40

9. 42°
10. 37°
11. 52°
12. 60°
13. 40°
14. 26°

Pages 24-25

1. cos A = .87; tan A = .58; ctn A = 1.7; sec A = 1.2; csc A = 2.

2. B = 45°; cos 45° = .71; sec 45° = 1.4; sin 45° = .71; ctn 45° = 1; csc 45° = 1.4.

3. sin 60° = 0.87; tan 60° = 1.7; sec 60° = 2.0; cos 60° = 0.50; ctn 60° = 0.58; csc 60° = 1.2.

4. sin 15° = 0.26
   cos 15° = 0.97
   tan 15° = 0.27
   ctn 15° = 3.7
   sec 15° = 1.0
   csc 15° = 3.9

7. sin 18° = 0.32
   cos 18° = 0.95
   tan 18° = 0.33
   ctn 18° = 3.0
   sec 18° = 1.1
   csc 18° = 3.2
   sin 72° = .95
   cos 72° = .32
   tan 72° = 3.0
   ctn 72° = 0.33
   sec 72° = 3.2
   csc 72° = 1.1

8. sin 23° = 0.38
   cos 23° = 0.92
   tan 23° = 0.42
   sec 23° = 1.1
   csc 23° = 2.6
   ctn 23° = 2.4

9. a = 16 in., b = 12 in.; ∠A = 53°; ∠B = 37°.

10. a = 12 in., c = 20 in.; ∠A = 37°; ∠B = 53°.

Pages 27-28

1. cos 61°
2. sin 68°
3. ctn 16°
4. tan 71°
5. csc 10°
6. cos 82°
7. sec 55°
8. ctn 59°
9. sin 45°
10. cos 45°
11. ctn 55°
12. tan 19°
13. ctn 2°
14. tan 14°
15. sin 13°
16. cos 26°
17. csc 42°
18. sec 33°
19. cos 2°54'
20. sin 33°28'

21. $\frac{2}{5}$. 22. $\frac{7}{4}$. 23. All false. 24. 45°. 25. 18°.
26. 15°. 27. 18°. 28. 15°. 29. 18°. 30. $\frac{5}{2}$.
31. $\frac{4}{7}$. 32. ± 1.

Page 31

1. 1.000	9. 1.040	17. 0.9407	25. 72°10'
2. 0.8387	10. 0.2126	18. 1.137	26. 42°30'
3. 0.2756	11. 0.3145	19. 4.989	27. 46°0'
4. 1.133	12. 0.8158	20. 0.1190	28. 31°0'
5. 3.078	13. 3.647	21. 36°50'	29. 84°50'
6. 0.7547	14. 1.039	22. 34°40'	30. 53°10'
7. 0.1564	15. 1.844	23. 61°20'	31. 38°0'
8. 1.963	16. 0.9407	24. 63°30'	32. 23°20'

Page 32

1. .3132	4. 1.043	7. 3.066	10. .9921
2. .8531	5. .9692	8. 1.165 (1.1654)	11. .4363
3. .6051	6. .9020	9. .9583	12. 1.057 (1.0567)

Page 33

1. 20°4'	4. 54°9'	7. 33°0'	10. 75°22'
2. 27°35'	5. 22°47'	8. 70°39'	11. 42°45'
3. 47°32'	6. 25°36'	9. 80°5'	12. 62°37'

Page 35

4. .9004 5. 33°40' 6. $\frac{1}{3}$

Page 37

1. sin, csc
2. cos, sec
3. sin, csc
4. sin, csc
5. cos, sec
6. cos, sec
7. 20.84, or 21.
8. 62.47, or 62.
9. 5.732, or 5.7
10. 239.4
11. 59.12 or 59.
12. 28.69, or 29.
13. 59°22'.
14. 56°56'.
15. 168.9 ft., or 169 ft.
16. 56°37'.
17. 439.4 ft.
18. 530.1 ft., or 530 ft.
19. 73°44', or 73°40'.
20. 28°57', or 29°.

21. 12.9 in.
22. 49°24', or 49°20'.
24. 113°35', or 113°30'.
25. 89.4, or 90.
26. 81.9 ft., or 82 ft.
27. 4619 ft., or 4600 ft.
28. 32.7 ft.

Pages 41-43

1. A = 47°50'; b = 13.3; c = 19.8
2. A = 47°26'; B = 42°34'; b = 321.5
3. B = 24°45'; b = 38.87; c = 92.84
4. A = 11°44'; b = 156.2; c = 159.5
5. A = 60°26'; B = 29°34'; c = 877.2
6. A = 66°37'; B = 23°23'; c = 70.5
7. A = 21°14'; B = 68°46'; b = 402.1
8. A = 55°7'; B = 34°53'; a = 5.973

9. 8 in.
10. 86°12'.
11. 23°5'.
12. 2 min. 8 sec. approx.
13. 11°6'.
14. 0°8'; .0023
15. 469 ft.
16. 22.8 ft.
17. $111.74
18. 14.4
19. 32.92 in.
20. .3 ft. farther.
21. 86.3 in.
22. 793 mph.
23. 1056 ft.
24. 1250 ft.
25. 18 ft. 4 in.; 39 ft. 4 in.
26. 228.3 ft.; 434.1 ft.
27. 94.8 ft.

Page 44

1. True
2. True
3. False
4. True
5. True
6. True
7. 1.
8. 2.
9. 30°
10. 30°

11. $\cos A = \frac{12}{13}$; $\operatorname{ctn} A = \frac{12}{5}$; $\csc A = \frac{13}{5}$; $\tan A = \frac{5}{12}$; $\sec A = \frac{13}{12}$.

12. $\sin B = \frac{5}{6}$; $\operatorname{ctn} B = \frac{2}{3}$; $\csc B = 1.2$; $\cos B = \frac{5}{9}$; $\sec B = 1.8$

13. $\sin A = .7183$; $\cos A = .6957$; $\tan A = 1.033$; $\operatorname{ctn} A = .9685$; $\csc A = 1.392$

14. Greater.

15. a. b b. b csc A c. ctn d. csc e. ctn

16. cofunction.

17. .0016.

Page 47

1. $\frac{1}{30}$; $\frac{1}{3000}$
2. .667
3. 4.8
4. 191.2
5. 45.4
6. 7.4
7. 19.0
8. 143.3
9. 78.6
10. 9.8
11. 4.79
12. 2.16
13. 23.15
14. 6.14
15. 7.28
16. 6.18
17. 4.20
18. 12.46

Page 49

1. 4 2. 3 3. 4 4. 4 5. 4 6. 4 7. 2 8. 4

9. 1 (if rounded to tens)
10. 1 (if rounded to hundreds)
11. 2 (if rounded to ten-thousands)
12. 2 (if rounded to millions)
13. 8420
14. 3.15
15. 47.6
16. 1600
17. .0417
18. 87,100
19. .0242
20. 0.715
21. 71,850
22. 6211
23. 3218
24. 7622
25. 480.8
26. 7.432
27. 749,100
28. 316,000

Pages 50-51

1. .05 sec.; .005 in.; .00005 in.; 500 mi.; 5000 mi.
2. .0052; .0004; .1250; .0200; .0208
3. 18.13 in.; equally accurate
4. 16.3 ft.; 71.43 ft.

Page 53

1. 7.0. 2. 181.4. 3. 508.2. 4. 341.6. 5. 4.3. 6. 220. 7. 3.91. 8. 44. 9. 11.1.

Pages 54-55

1. 3. 2. 4. 3. 1. 4. 3. 5. 3. 6. 3. 7. 3. 8. 2. 9. 203; 18.3. 10. 1.32; 1.32.

Pages 55-56

1. 1.62×10^{3}
2. 8×10^{2}
3. 4.6×10
4. 7.5×10^{4}
5. 2.1300×10^{-1}
6. 1.39×10

7. 5×10^{-2}
8. 7.2×10^{-3}
9. 6.5×10^{-2}
10. 1.6×10^{-3}
11. 9.3×10^{7}
12. 2.4×10^{5}
13. 5×10^{-5} cm.
14. 45,000,000,000 years
15. 1.55×10^{8} mi.
16. 3.6×10^{9} mi.
17. .0000003 sec.
18. .0000000135 cm.
19. 400,000
20. .00000002

Pages 58-59

1. $\log_4 16 = 2$
2. $\log_5 25 = 2$
3. $\log_{10} 100 = 2$
4. $\log_9 81 = 2$
5. $\log_2 16 = 4$
6. $\log_2 32 = 5$
7. $\log_{10} 10{,}000 = 4$
8. $\log_4 1 = 0$
9. $\log_5 625 = 4$
10. $\log_2 128 = 7$
11. $\log_7 343 = 3$
12. $\log_x 40 = 3$
13. $\log_{10} 1 = 0$
14. $\log_{10} 10 = 1$
15. $\log_4 \frac{1}{16} = -2$
16. $\log_{10} .01 = -2$
17. $\log_{10} .001 = -3$
18. $\log_8 512 = 3$
19. $\log_8 1 = 0$
20. $\log_2 .125 = -3$
21. $\log_5 .04 = -2$
22. $10^2 = 100$
23. $4^1 = 4$ or $4 = 4$
24. $10^1 = 10$ or $10 = 10$
25. $10^0 = 1$
26. $4^3 = 64$
27. $7^2 = 49$
28. $4^x = x$
29. $10^{.602} = 4$
30. $3^5 = 243$
31. $4^4 = 256$
32. $10^{.903} = 8$
33. $10^{.69} = 4.9$
34. 4
35. 2
36. 2
37. 1
38. 2
39. 3
40. 2
41. 0
42. 0
43. 1
44. -2
45. 2

Page 61

1. $\log 7.476 = 0.87367$ $\quad 7.476 = 10^{0.87367}$
2. $\log 4.163 = 0.61941$ $\quad 4.163 = 10^{0.61941}$
3. $\log 5.214 = 0.71717$ $\quad 5.214 = 10^{0.71717}$
4. $\log 4.325 = 0.63599$ $\quad 4.325 = 10^{0.63599}$
5. $\log 2.81 = 0.44871$ $\quad 2.81 = 10^{0.44871}$
6. $\log 7.5 = 0.87506$ $\quad 7.5 = 10^{0.87506}$
7. $\log 4.49 = 0.65225$ $\quad 4.49 = 10^{0.65225}$
8. $\log 9.31 = 0.96895$ $\quad 9.31 = 10^{0.96895}$
9. $\log 8 = 0.90309$ $\quad 8 = 10^{0.90309}$
10. $\log 6 = 0.77815$ $\quad 6 = 10^{0.77815}$
11. $\log 1.428 = 0.15473$ $\quad 1.428 = 10^{0.15473}$
12. $\log 8.462 = 0.92747$ $\quad 8.462 = 10^{0.92747}$

13. $\log 2.9 = 0.46240$ $\quad 2.9 = 10^{0.46240}$
14. $\log 1.1 = 0.04139$ $\quad 1.1 = 10^{0.04139}$
15. $\log 7.368 = 0.86735$ $\quad 7.368 = 10^{0.86735}$
16. $\log 8.254 = 0.91666$ $\quad 8.254 = 10^{0.91666}$

Page 62

1. 5.805
2. 2.702
3. 1.152
4. 1.875
5. 5.485
6. 9.742, approx.
7. 1.806, approx.
8. 1.005
9. 1.241
10. 6.009
11. 9.245
12. 2.755, approx.
13. 1.605
14. 2.445
15. 1.877, approx.
16. 5.871, approx.

Pages 63-64

1. a. 3.25792 b. 1.25792 c. 2.25792 d. 4.25792
2. a. 1.92474 b. 2.92474 c. 3.92474 d. 4.92474
3. a. 3.87633 b. 4.87633 c. 1.87633 d. 2.87633
4. a. 1.60206 b. 2.60206 c. 3.60206 d. 5.60206
5. a. 0.76582 b. 1.76582 c. 3.76582 d. 4.76582
6. a. 2.98023 b. 0.98023 c. 3.98023 d. 4.98023
7. Their mantissa.
8. $\log 763.4 = 2.88275$
9. $\log 0.2789 = 0.44545-1$

Page 65

1. 3.92752
2. 1.44607
3. 0.66577
4. 2.97845
5. 2.71433
6. 0.87506
7. 0.68215
8. 2.73640
9. 0.90309
10. 3.
11. 2.34025
12. 1.54108
13. 3.96914
14. 3.87864
15. 3.84547

Page 66

1. $10^{9.92941-10}$
2. $10^{8.04139-10}$
3. $10^{6.23070-10}$
4. $10^{6.69504-10}$
5. $10^{5.4284-10}$
6. $10^{5.34998-10}$
7. 7.64171-10
8. 6.6218-10
9. 9.2173-10
10. 3.2164-10
11. 5.4632-10
12. 6.2178-10

Page 67

1. 9.67742-10
2. 9.83828-10
3. 7.89209-10
4. 6.69897-10
5. 9.50705-10
6. 8.20140-10
7. 9.72616-10
8. 9.96123-10

9. 9.05115-10	11. 7.67210-10	13. 8.66577-10	15. 6.90309-10
10. 7.79934-10	12. 9.51188-10	14. 9.44700-10	16. 8.90849-10

Page 68 (top)

1. 7001	5. .03288	9. 291.1
2. 51,850	6. .007435	10. .07960, to nearest .00001
3. 58.06	7. 393.6	11. .002226
4. 785.5	8. 23.71	12. .3835

Page 68 (bottom)

1. 0; 1.0	2. 0	3. Increases	4. 0; 1

Page 72

To 4 significant figures:

1. 1,152,000	7. 808,000,000	13. 1.718
2. 32.30	8. 4,215,000,000	14. 1.476
3. 10.97	9. 467,700	15. .8812
4. 73.30	10. 1905	16. .009768
5. 20.88	11. .002649	17. .002000
6. 5.183	12. 15.41	18. 3.200

Page 73

1. Negative; positive	4. 0.38091	7. 5.88874-10
2. 8.10685-10	5. 1.13787	8. 3.19382
3. 7.78675-10	6. 5.48360-10	9. 1.79778

Page 75

1. 1.62476	4. 2.85835	7. 3.28199	10. 0.63566
2. 3.89211	5. 7.85652	8. 8.92528-10	11. 0.96428
3. 3.71996	6. 8.63474-10	9. 9.66415-10	12. 2.53380

Page 76

1. 58.355	5. 20.063	9. 6257
2. 10,555	6. 25,119	10. .000000042624
3. .009306	7. .00031623	11. 115.23
4. 31,796	8. .0099555	12. 1765.2

Page 77

1. 387,950
2. 157,290
3. 514.14
4. -.035393
5. 53.314
6. 6,835,800
7. -9.773
8. -407,890,000
9. 60.18
10. 40,686,000,000
11. 1.3638
12. 2.6542

Page 78

1. 48.879
2. 19.190
3. 348.87
4. 135.33
5. .76342
6. 1.5449
7. 16.199
8. 7.2952
9. 444.6
10. 116.27
11. .15385
12. 101.63

Pages 78-80

1. 1.55630 2.33445 2.77815 0.38908
2. 0.30103 0.60206 1.50515 1.20412 2.09691
3. 2.4771 1.0458
4. 0.6990
5. 9.1549-10 2.5353
6. 0.7782
7. 43 sq. in. 43.32 sq. in.

*8. 146.9 sq. in. (146.92)
9. 22.8 sq. in. (22.795)
10. 446 sq. in. (445.53)
11. 3.3 (3.3238)
12. 1302 (1302.5)
13. 397 H.P. (397.31)
14. .6 H.P. (.62247)
15. 41,600 (41,560)
16. 31 (31.114)
17. 400 bu. (433.92)
18. 1430 sq. in. (1425.5)
19. $90 (85.916)

Pages 80-81

1. 3
2. 2
3. 4
4. 3
5. 3
6. 1
7. 5
8. -2
9. -3
10. 7
11. 3.3219
12. 3.5462
13. 76.442
14. 54.899
15. 8.0856
16. $17\frac{1}{2}$ yr.
17. 2.9%
18. $2970

Page 82

1. 1.6610
2. 2.7268
3. 3.1610
4. 2.8613
5. 1.5
6. 1.8614
7. 4.1134
8. 3.3219
9. 1

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*Double answers are given as an aid in checking computation. The first one has been rounded; the second contains the number of significant figures in the table.

Pages 84-85

1. 9.26063-10
2. 9.64517-10
3. 9.87557-10
4. 0.50348
5. 0.12683
6. 9.87668-10
7. 9.15245-10
8. 9.99262-10
9. 9.76167-10
10. 9.47350-10
11. 0
12. 0
13. 0.64786
14. 9.95967-10
15. 9.92181-10
16. 0.02762
17. 0.11831
18. 0.24603
19. 0.02085
20. 0.84799
21. 0.57642
22. 8.07826-10
23. 7.76764-10
24. 9.99995-10
25. 9.99992-10
26. 8.41807-10
27. 8.16417-10
28. 8.35728-10
29. 7.90307-10
30. 7.40572-10
31. 9.99974-10
32. 8.16776-10
33. 8.26598-10

Page 86

1. 26°46'
2. 10°24'26"
3. 43°50'
4. 47°42'
5. 16°30'8"
6. 14°15'11"
7. 10°26'30"
8. 77°18'39"
9. 61°24'10"
10. 11°20'23"
11. 28°27'50"
12. 62°20'30"

Pages 86-87

1. 7.26×10^{4}
2. 4.712×10
3. 1.6×10^{-3}
4. 4.9×10^{-4}
5. 2.4×10^{5}
6. 1.93×10^{8}
7. a. 1760
   b. 8140
   c. 84.6
   d. 7.93
   e. 42.6
   f. 184
8. 4.9
9. 2.753 (2.7526)
10. 2.6 (2.556)
11. 110 (113.6)
12. 7.2
13. 11.7

14-17. 2, 0, -3, 2

18-21. 2, 1, -3, -1

22-25. 2, 4, -1, 2

26. 37.8 (37.808)
27. 248.3 (248.34)
28. 1.9870
29. 16,347
30. 3.8834
31. 51,580 (51,579)
32. 3.74 (3.7392)
33. 3.7974
34. 5.6053
35. .834 (.83443)
36. 190 (190.91)
37. 2.38 (2.3751)
38. 170 (169.57)
39. -1.70 (-1.7040)
40. .41 (.40605)
41. 0.30103; 1.20412; 9.39794-10
42. 0.4771; 1.4313; 0.0458
43. .5148; .1287
44. 0.6990; 2.6990

45. 4
46. 5
47. .53565
48. 6.1286
49. 3
50. -.7272
51. mantissa; characteristic
52. 9.69897-10
53. a + b; a - b; 2a - b; a - 2b
54. $\log t = \frac{1}{2}(\log 2 + \log s - \log g)$
55. 9.50037-10
56. 9.94903-10
57. 9.27543-10
58. 0.51252

Page 94*

1. 14
2. 30
3. 200
4. 1620
5. 736
6. 4720
7. 972
8. 6050
9. 210,000
10. 15.4
11. 6680
12. 1,370,000

Page 95

1. 16
2. 6
3. 4
4. 31
5. 39
6. 18
7. .549
8. 190
9. .222
10. 16.9
11. 164
12. 13.6

Page 96

1. 81
2. 64
3. 49
4. 144
5. 4100
6. 2810
7. 858
8. 5130
9. 25
10. 28
11. 13
12. 35
13. 45
14. 36
15. 3.16
16. 2.83
17. 11.2
18. 2.20
19. 2.12
20. 22.7

Page 97

1. 4.80
2. 4.67
3. 259
4. 30.3
5. 40.2
6. 5.10
7. 17.5
8. 415
9. 18.8

Page 98

1. 11.5
2. 7.81
3. 1300
4. .00858
5. 168
6. 2.89
7. 4.58
8. 102
9. 6.21
10. 6600

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*Results in this chapter are given to 3 significant figures.

Page 100 (top)

1. .951	5. .264	9. .342	13. .219
2. .225	6. .770	10. .574	14. .171
3. .267	7. .645	11. .951	15. .709
4. .0174	8. .999	12. .914	16. .942

Page 100 (foot)

1. 3.09 2. 8.62 3. 14.7 4. 55.3 5. 13.7 6. 19.5

Page 101

1. .445	4. .371	7. 1.00	10. .0408
2. .839	5. .135	8. .922	11. .0929
3. .271	6. .786	9. .0699	12. .0175

Page 102 (top)

1. 11.4	3. 1.19	5. 5.88	7. 1.11
2. 3.73	4. 2.14	6. 2.10	8. 2.36

Page 102 (foot)

1. 30.4	3. 4.02	5. 5.36	7. 56
2. 210	4. 57.6	6. 34.5	

Page 103

1. Yes	8. .829	14. 63.0	20. 9.17
2. B	9. .268	15. 81.5	21. 40.2
3. D	10. .176	16. 2330	22. 9.36
4. A and D	11. .906	17. 2400	23. 16.7
5. Mantissa	12. .156	18. 2810	
7. .470	13. 5.94	19. 21.7	

Pages 109-110

1. A = 55°50'; b = 287.11, or 287; c = 511.23, or 511.
2. A = 62°30'; a = 338.08, or 338; c = 381.15, or 381.
3. A = 31°28'; a = 1025.2, or 1025; b = 1675.2, or 1675.
4. B = 27°37'; a = 378.35, or 378.4; b = 197.94, or 197.9.

5. A = 35°11'49", or 35°12'; B = 54°48'11", or 54°48'; c = 54.199, or 54.20.

6. A = 54°5'25", or 54°10'; B = 35°54'35", or 35°50'; c = 21.483, or 21.5.

7. A = 30°0'; B = 60°0'; b = 29.947, or 29.95.

8. A = 60°0'; B = 30°0'; a = 73.785, or 73.8.

9. B = 69°27'15"; a = 331.24; b = 883.78.

10. A = 16°41'22", or 16°41'20"; a = 228.42; b = 761.87.

11. B = 64°46'42", or 64°46'40"; a = .82526; b = 1.7521.

12. A = 8°42'45"; c = 14.173; b = 14.010.

13. 11.542, or 11.5 in.

14. 16.825, or 16.82 inches.

15. 3.7344, or 3.73 in.

16. 21.719 in.

17. 35°50'30", or 35°50'

18. 70.534, or 70.53 in.

19. 3.103 in.

20. 60°42'30", or 61°.

21. 98.362, or 98.4 ft.

22. 3.4413, or 3.44 in.

23. 33°41'24"
56°18'36"

24. 34°59'31", or 35°.

25. 13.866 in.

Pages 111-112

1. 1293.4, or 1293

2. .0031536, or .00315

3. 475.94

4. 2076.6, or 2080

5. 393,890, or 393,900

6. 31,024, or 31,020

7. 2702.7, or 2703

8. 5208.0

9. 16.524

10. 19°8'54", or 19°

11. 4481.13, or 4500 sq. ft.

12. 143.88, or 144 sq. in.

Page 113

1. B = A; C = 180° - 2A; $b = \frac{\frac{1}{2}c}{\cos A}$; a = b; $h = \frac{1}{2}c \tan A$.

2. B = A; C = 180° - 2A; $c = \frac{2h}{\tan A}$; $b = \frac{h}{\sin A}$; a = b.

3. A = B; C = 180° - 2B; b = a; c = 2a cos B; h = a sin B.

4. A = B; C = 180° - 2B; $a = \frac{h}{\sin B}$; b = a; c = 2h ctn B.

5. $A = B = \frac{1}{2}(180° - C)$; $b = \frac{\frac{1}{2}c}{\cos A}$; a = b; $h = \frac{1}{2}c \tan B$.

6. $A = B = \frac{1}{2}(180° - C)$; c = 2h ctn A; $b = \frac{h}{\sin A}$; a = b.

7. B = A; C = 180° - 2A; a = b; h = b sin A; c = 2b cos A.

8. $a = b = \sqrt{h^2 + \frac{c^2}{4}}$; $\sin A = \frac{h}{b}$; $A = B$; $C = 180° - 2A$.

9. C = 102°36'; c = 18.418, or 18.42; h = 7.3778, or 7.378.

10. A = B = 73°38'35", or 73°40'; C = 32°42'50", or 32°40'; h = 140.37, or 140.

11. C = 70°56'; c = 250.92, or 250.9; a = b = 216.22, or 216.2.

12. A = B = 75°44'18", or 75°44'20"; C = 28°35'24", or 28°35'25"; h = 22.431.

13. A = B = 62°36'30", or 62°36'; a = b = 7842.4, or 7842; h = 6963.2, or 6963.

14. C = 122°54'; c = 34.186, or 34.19; h = 9.3004, or 9.300.

15. 281.03, or 280 sq. ft.

16. 1021.4, or 1000 sq. in.

17. 4326.4, or 4300 sq. in.

18. 72.100, or 72 in.; 120.008, or 120 in.

Page 115

1. 117.56, or 120 in.
2. 61.2288, or 61 in.
3. 9.2376, or 9.2 ft.
4. 25.565, or 25.56 in.
5. r = 19.754, or 20 in.; s = 6.2572, or 6.3 in.
6. 1.15470 in., approx.
7. 554.39, or 550 sq. in.
8. 73.472, or 73 sq.in.

Pages 119-122

1. a. 0°; b. 90°; c. 60°; d. 30°.
2. 5.7544, or 5.754 in.; 5.5576, or 5.558 in.
3. 5.0344, or 5.034 in.; 6.2168, or 6.217 in.
4. 38°0'2", or 38°.
5. 590.32, or 590 sq. ft.
6. 34°24'40", or 34°20'.
7. 8.7296, or 8.7 knots south; 9.3614, or 9.4 knots east.
8. 12.960, or 13 knots north; 6.0436, or 6.0 knots west.
9. Zero.
10. N40°36'E, or N40°E.
11. 1687.3, or 1700 ft. north; 751.24 or 750 ft. east.
12. 13,846, or 13,850 ft. south; 3,366.8, or 3,367 ft. west.
13. S86°W; N54°W.
14. N88°42'W; S29°18'W.

15. 3°15'26", or 3°.
16. 287°47'57", or 290°.
17. 561.55, or 560 ft.
18. 97.895, or 98 miles north; 69.400, or 69 miles east.
19. 198°12'49", or 200°.
20. 129.50, or 130 ft.
21. 22.452, or 22 m.p.h.
22. 22.694, or 23 miles; 9.4 miles.
23. 700.07, or 700 ft. south; 637.75, or 638 ft. east.

Page 124 (top)

Note: Results are given to three significant figures when a slide rule has been used.

1. a = 24.2; b = 35.2; B = 55°30'
2. A = 41°10'; a = 30.4; c = 46.2
3. B = 14°30'; b = 11.1; c = 44.2
4. B = 27°15'; a = 30.4'; b = 15.7
5. A = 69°32'; a = 323; b = 121
6. A = 52°25'; b = 149; c = 245

Pages 124-125

1. true	3. false	5. true	7. true	9. true
2. true	4. true	6. true	8. false	10. false

11. cosine, cotangent, cosecant.
12. 45°
13. Logarithms can be used to find a product.

14. 9.72693-10	17. 87°14'38"	20. Solvable
15. 0.64458	18. Not solvable	21. .57746, or .577
16. 73°5'1"	19. Solvable	

22. A = 62°59'21", or 63°00'; B = 27°0'39", or 27°00'; c = 517.44, or 517.
23. B = 53°42'; b = 183.38, or 183.4; c = 227.53, or 227.5.
24. A = 18°36'; b = 498.61, or 498.6; c = 526.08, or 526.1.
25. A = 32°21'39", or 32°22'; B = 57°38'21", or 57°38'; b = 6.6850, or 6.685.
26. 43,830 square units.

27. C = 71°48'; B = 36°24'; a = c = 39.509, or 39.51; h = 37.533. or 37.53.

28. 1483.7, or 1484 sq. in.

29. 53.789, or 53.8 miles.

30. 51.829, or 52 in.

31. b = 336; c = 417; B = 53°40'

32. A = 58°10'; a = 72.8; c = 85.7

33. B = 63°; a = 59.5; b = 117.

34. .10678, or .11 amperes.

Pages 130-131

1. a. I and II; III and IV. b. I and IV; II and III. c. I and III; II and IV.

2. a. II. b. III. c. IV. d. I.

3. a. Quadrant III: $\cos\theta = -\frac{\sqrt{5}}{3}$; $\tan\theta = \frac{2\sqrt{5}}{5}$; $\operatorname{ctn}\theta = \frac{\sqrt{5}}{2}$;

$\sec\theta = -\frac{3\sqrt{5}}{5}$; $\csc\theta = -\frac{3}{2}$.

Quadrant IV: $\cos\theta = \frac{\sqrt{5}}{3}$; $\tan\theta = -\frac{2\sqrt{5}}{5}$; $\operatorname{ctn}\theta = -\frac{\sqrt{5}}{2}$;

$\sec\theta = \frac{3\sqrt{5}}{5}$; $\csc\theta = -\frac{3}{2}$.

b. Quadrant I: $\sin\theta = \frac{\sqrt{3}}{2}$; $\tan\theta = \sqrt{3}$; $\operatorname{ctn}\theta = \frac{\sqrt{3}}{3}$;

$\sec\theta = 2$; $\csc\theta = \frac{2\sqrt{3}}{3}$.

Quadrant IV: $\sin\theta = -\frac{\sqrt{3}}{2}$; $\tan\theta = -\sqrt{3}$; $\operatorname{ctn}\theta = -\frac{\sqrt{3}}{3}$;

$\sec\theta = 2$; $\csc\theta = -\frac{2\sqrt{3}}{3}$.

c. Quadrant I: $\sin\theta = \frac{4\sqrt{41}}{41}$; $\cos\theta = \frac{5\sqrt{41}}{41}$; $\operatorname{ctn}\theta = \frac{5}{4}$;

$\sec\theta = \frac{\sqrt{41}}{5}$; $\csc\theta = \frac{\sqrt{41}}{4}$.

Quadrant III: $\sin\theta = -\frac{4\sqrt{41}}{41}$; $\cos\theta = -\frac{5\sqrt{41}}{41}$; $\operatorname{ctn}\theta = \frac{5}{4}$;

$\sec\theta = -\frac{\sqrt{41}}{5}$; $\csc\theta = -\frac{\sqrt{41}}{4}$.

d. Quadrant II: $\sin\theta = \frac{4}{5}$; $\cos\theta = -\frac{3}{5}$; $\tan\theta = -\frac{4}{3}$;

$\sec\theta = -\frac{5}{3}$; $\csc\theta = \frac{5}{4}$.

Quadrant IV: $\sin\theta = -\frac{4}{5}$; $\cos\theta = \frac{3}{5}$; $\tan\theta = -\frac{4}{3}$;

$\sec\theta = \frac{5}{3}$; $\csc\theta = -\frac{5}{4}$.

e. Quadrant I: $\sin\theta = \frac{5}{13}$; $\cos\theta = \frac{12}{13}$; $\tan\theta = \frac{5}{12}$;

$\operatorname{ctn}\theta = \frac{12}{5}$; $\csc\theta = \frac{13}{5}$.

Quadrant IV: $\sin\theta = -\frac{5}{13}$; $\cos\theta = \frac{12}{13}$; $\tan\theta = -\frac{5}{12}$;

$\operatorname{ctn}\theta = -\frac{12}{5}$; $\csc\theta = -\frac{13}{5}$.

f. Quadrant II: $\sin\theta = \frac{3\sqrt{58}}{58}$; $\cos\theta = -\frac{7\sqrt{58}}{58}$; $\operatorname{ctn}\theta = -\frac{7}{3}$;

$\sec\theta = -\frac{\sqrt{58}}{7}$; $\csc\theta = \frac{\sqrt{58}}{3}$.

Quadrant IV: $\sin\theta = -\frac{3\sqrt{58}}{58}$; $\cos\theta = \frac{7\sqrt{58}}{58}$; $\operatorname{ctn}\theta = -\frac{7}{3}$;

$\sec\theta = \frac{\sqrt{58}}{7}$; $\csc\theta = -\frac{\sqrt{58}}{3}$.

g. Quadrant I: $\sin\theta = \frac{2}{3}$; $\cos\theta = \frac{\sqrt{5}}{3}$; $\tan\theta = \frac{2\sqrt{5}}{5}$;

$\operatorname{ctn}\theta = \frac{\sqrt{5}}{2}$; $\sec\theta = \frac{3\sqrt{5}}{5}$

Quadrant II: $\sin\theta = \frac{2}{3}$; $\cos\theta = -\frac{\sqrt{5}}{3}$; $\tan\theta = -\frac{2\sqrt{5}}{5}$;

$\operatorname{ctn}\theta = -\frac{\sqrt{5}}{2}$; $\sec\theta = -\frac{3\sqrt{5}}{5}$.

h. Quadrant II: $\sin\theta = \frac{\sqrt{21}}{5}$; $\tan\theta = -\frac{\sqrt{21}}{2}$; $\operatorname{ctn}\theta = -\frac{2\sqrt{21}}{21}$;

$\sec\theta = -\frac{5}{2}$; $\csc\theta = \frac{5\sqrt{21}}{21}$.

Quadrant III: $\sin\theta = -\frac{\sqrt{21}}{5}$; $\tan\theta = \frac{\sqrt{21}}{2}$; $\operatorname{ctn}\theta = \frac{2\sqrt{21}}{21}$;

$\sec\theta = -\frac{5}{2}$; $\csc\theta = -\frac{5\sqrt{21}}{21}$.

i. Quadrant II: $\sin\theta = \frac{4}{5}$; $\cos\theta = -\frac{3}{5}$; $\tan\theta = -\frac{4}{3}$;

$\operatorname{ctn}\theta = -\frac{3}{4}$; $\csc\theta = \frac{5}{4}$.

Quadrant III: $\sin\theta = -\frac{4}{5}$; $\cos\theta = -\frac{3}{5}$; $\tan\theta = \frac{4}{3}$;

$\operatorname{ctn}\theta = \frac{3}{4}$; $\csc\theta = -\frac{5}{4}$.

4. a. Quadrant IV: $\sin\theta = -\frac{\sqrt{33}}{7}$; $\tan\theta = -\frac{\sqrt{33}}{4}$; $\operatorname{ctn}\theta = -\frac{4\sqrt{33}}{33}$;

$\sec\theta = \frac{7}{4}$; $\csc\theta = -\frac{7\sqrt{33}}{33}$.

b. Quadrant III: $\sin\theta = -\frac{15}{17}$; $\tan\theta = \frac{15}{8}$; $\operatorname{ctn}\theta = \frac{8}{15}$;

$\sec\theta = -\frac{17}{8}$; $\csc\theta = -\frac{17}{15}$.

c. Quadrant II: $\sin\theta = \frac{12}{13}$; $\cos\theta = -\frac{5}{13}$; $\tan\theta = -\frac{12}{5}$;

$\operatorname{ctn}\theta = -\frac{5}{12}$; $\csc\theta = \frac{13}{12}$.

d. Quadrant III: $\cos\theta = -\frac{\sqrt{51}}{10}$; $\tan\theta = \frac{7\sqrt{51}}{51}$; $\operatorname{ctn}\theta = \frac{\sqrt{51}}{7}$;

$\sec\theta = -\frac{10\sqrt{51}}{51}$; $\csc\theta = -\frac{10}{7}$.

e. Quadrant III: $\sin\theta = -\frac{x\sqrt{x^2+1}}{x^2+1}$; $\cos\theta = -\frac{\sqrt{x^2+1}}{x^2+1}$;

$\operatorname{ctn}\theta = \frac{1}{x}$; $\sec\theta = -\sqrt{x^2+1}$; $\csc\theta = -\frac{\sqrt{x^2+1}}{x}$.

f. Quadrant I: $\cos\theta = \sqrt{1-y^2}$; $\tan\theta = \frac{y\sqrt{1-y^2}}{1-y^2}$;

$\operatorname{ctn}\theta = \frac{\sqrt{1-y^2}}{y}$; $\sec\theta = \frac{\sqrt{1-y^2}}{1-y^2}$; $\csc\theta = \frac{1}{y}$.

5. $\frac{7}{25}$. 6. $-\frac{12}{31}\sqrt{10}$.

Page 134

1. a. sin 15°
b. csc 55°
c. -ctn 10°
d. -cos 65°
e. -tan 35°
f. -sec 80°
g. tan 10°
h. -cos 32°
i. ctn 70°
j. -sin 20°
k. -csc 55°
l. -sec 5°
m. -sin 19°54'
n. cos 78°50'
o. sec 59°40'
p. -tan 9°10'
q. -ctn 36°11'
r. -csc 64°4'

2. a. .9659
b. -.8192
c. -.5317
d. 9.514
e. -7.661
f. -4.390
g. 2.455
h. -.7509
i. .8924
j. 3.185
k. .3788
l. 1.011

3. a. 2 tan θ sin θ
b. -2 sin θ cos θ
c. -2 sec θ csc θ

4. a. -.7923
b. 0
c. -3.4724

Page 135

1. a. $\frac{1}{2}$. b. -2. c. $\frac{1}{2}\sqrt{3}$. d. $-\sqrt{3}$. e. $\frac{1}{3}\sqrt{3}$. f. 2. g. $\frac{1}{2}\sqrt{2}$. h. $-\frac{1}{2}\sqrt{2}$. i. $-\sqrt{2}$. j. $-\frac{1}{3}\sqrt{3}$. k. $\sqrt{3}$. l. $-\frac{1}{2}\sqrt{3}$. m. $-\frac{1}{2}\sqrt{2}$. n. 1. o. $-\frac{1}{3}\sqrt{3}$.

2. a. $\frac{1}{6}(\sqrt{3} + \sqrt{6})$. b. $\frac{3}{8}$. c. 0.

Pages 136-137

1-12. See table on p. 136 of the text.
13. -2. 14. 1. 15. 2.

Pages 137-138

1. -sin 25°
2. cos 36°
3. -tan 20°
4. ctn 55°
5. -sec 29°
6. -csc 85°
7. -cos 10°
8. -sec 68°
9. sin 57°
10. tan 69°
11. csc 78°
12. -ctn 80°
13. sin 65°
14. -cos 17°
15. sec 12°
16. $1 - \frac{1}{4}\sqrt{2}$
17. $-1\frac{1}{2}$
18. $1\frac{3}{4}$
19. 2
20. $-\frac{1}{6}\sqrt{6}$

Pages 140-141

1. a. cos 72°
   b. cos 5°
   c. -cos 58°
   d. -cos 50°
   e. sin 20°
   f. -sin 40°
   g. sin 25°
   h. sin 80°
   i. ctn 78°
   j. -ctn 70°
   k. ctn 80°
   l. -ctn 60°
   m. tan 87°
   n. -tan 30°
   o. tan 20°
   p. -tan 25°
   q. csc 68°
   r. -csc 70°
   s. -csc 68°
   t. csc 74°
   u. -sec 83°
   v. -sec 20°
   w. sec 8°
   x. -sec 30°

2. a. 0; b. $-\cos\theta(\sin\theta + \cos\theta)$; c. $-(\csc^2\theta + \sec^2\theta)$; d. $\tan^2\theta - \operatorname{ctn}^2\theta$.

3. a. $\sin\theta$; b. $\tan(80° + \theta)$; c. $-\sec\theta$; d. $\sin\theta$; e. $\operatorname{ctn}\theta$; f. $\csc(40° + \theta)$.

Page 141

1. (Values are given in the order: sin, cos, tan, ctn, sec, csc.)

a. I: $\frac{2}{3}$; $\frac{\sqrt{5}}{3}$; $\frac{2\sqrt{5}}{5}$; $\frac{\sqrt{5}}{2}$; $\frac{3\sqrt{5}}{5}$; $\frac{3}{2}$.

II: $\frac{2}{3}$; $-\frac{\sqrt{5}}{3}$; $-\frac{2\sqrt{5}}{5}$; $-\frac{\sqrt{5}}{2}$; $-\frac{3\sqrt{5}}{5}$; $\frac{3}{2}$.

b. II: $\frac{\sqrt{2}}{2}$; $-\frac{\sqrt{2}}{2}$; -1; -1; $-\sqrt{2}$; $\sqrt{2}$.

III: $-\frac{\sqrt{2}}{2}$; $-\frac{\sqrt{2}}{2}$; 1; 1; $-\sqrt{2}$; $-\sqrt{2}$.

c. I: $\frac{3}{5}$; $\frac{4}{5}$; $\frac{3}{4}$; $\frac{4}{3}$; $\frac{5}{4}$; $\frac{5}{3}$.

III: $-\frac{3}{5}$; $-\frac{4}{5}$; $\frac{3}{4}$; $\frac{4}{3}$; $-\frac{5}{4}$; $-\frac{5}{3}$.

d. II: $\frac{3\sqrt{10}}{10}$; $-\frac{\sqrt{10}}{10}$; -3; $-\frac{1}{3}$; $-\sqrt{10}$; $\frac{\sqrt{10}}{3}$.

IV: $-\frac{3\sqrt{10}}{10}$; $\frac{\sqrt{10}}{10}$; -3; $-\frac{1}{3}$; $\sqrt{10}$; $-\frac{\sqrt{10}}{3}$.

e. I: $\frac{12}{13}$; $\frac{5}{13}$; $\frac{12}{5}$; $\frac{5}{12}$; $\frac{13}{5}$; $\frac{13}{12}$.

IV: $-\frac{12}{13}$; $\frac{5}{13}$; $-\frac{12}{5}$; $-\frac{5}{12}$; $\frac{13}{5}$; $-\frac{13}{12}$.

f. II: $\frac{4\sqrt{65}}{65}$; $-\frac{7\sqrt{65}}{65}$; $-\frac{4}{7}$; $-\frac{7}{4}$; $-\frac{\sqrt{65}}{7}$; $\frac{\sqrt{65}}{4}$.

IV: $-\frac{4\sqrt{65}}{65}$; $\frac{7\sqrt{65}}{65}$; $-\frac{4}{7}$; $-\frac{7}{4}$; $\frac{\sqrt{65}}{7}$; $-\frac{\sqrt{65}}{4}$.

g. III: $-\frac{\sqrt{2}}{2}$; $-\frac{\sqrt{2}}{2}$; 1; 1; $-\sqrt{2}$; $-\sqrt{2}$.

IV: $-\frac{\sqrt{2}}{2}$; $\frac{\sqrt{2}}{2}$; -1; -1; $\sqrt{2}$; $-\sqrt{2}$.

h. III: $-\frac{1}{5}$; $-\frac{2\sqrt{6}}{5}$; $\frac{\sqrt{6}}{12}$; $2\sqrt{6}$; $-\frac{5\sqrt{6}}{12}$; -5.

IV: $-\frac{1}{5}$; $\frac{2\sqrt{6}}{5}$; $-\frac{\sqrt{6}}{12}$; $-2\sqrt{6}$; $\frac{5\sqrt{6}}{12}$; -5.

i. I: $\frac{3\sqrt{5}}{7}$; $\frac{2}{7}$; $\frac{3\sqrt{5}}{2}$; $\frac{2\sqrt{5}}{15}$; $\frac{7}{2}$; $\frac{7\sqrt{5}}{15}$.

IV: $-\frac{3\sqrt{5}}{7}$; $\frac{2}{7}$; $-\frac{3\sqrt{5}}{2}$; $-\frac{2\sqrt{5}}{15}$; $\frac{7}{2}$; $-\frac{7\sqrt{5}}{15}$.

2. a. $\sin 25°$ d. $-\tan 42°$ g. $-\sin 50°$ j. $\operatorname{ctn} 33°$
b. $-\cos 20°$ e. $-\operatorname{ctn} 20°$ h. $-\sec 15°$ k. $\operatorname{ctn} 0°$
c. $-\cos 20°$ f. $-\sec 20°$ i. $\sin 68°$ l. $-\csc 90°$

3. a. $\sin\theta(\cos\theta + \sin\theta)$ d. $\sin\theta(\cos\theta + 1) - \operatorname{ctn}\theta$
b. $\sin\theta(\cos\theta - 1) - \operatorname{ctn}\theta$ e. $2\cos\theta - \frac{\sqrt{3}}{2}\tan\theta$
c. $-\sin\theta\cos^2\theta$

4. a. $1 + \frac{4}{3}\sqrt{3}$. b. .6840 c. -1

5. $\sin C = .9397$ $\cos C = -.3420$ $\tan C = -2.747$
$\operatorname{ctn} C = -.3640$ $\sec C = -2.924$ $\csc C = 1.064$

Pages 145-146

Ex. 1-16 and 29-36 are in radians.

1. $\frac{\pi}{10}$. 2. $\frac{\pi}{2}$. 3. π. 4. $\frac{\pi}{4}$. 5. $\frac{\pi}{6}$. 6. 2π.

7. $\frac{\pi}{12}$. 8. $\frac{\pi}{3}$. 9. $\frac{2\pi}{3}$. 10. $\frac{3\pi}{4}$. 11. $\frac{3\pi}{2}$. 12. $\frac{3\pi}{8}$.

13. $\frac{\pi}{8}$. 14. $\frac{10\pi}{9}$. 15. $\frac{5\pi}{3}$. 16. 4π.

17. 180°
18. 360°
19. 90°
20. 60°
21. 45°
22. 36°
23. 120°
24. 135°
25. 9°
26. 270°
27. 225°
28. 12°
29. .87266
30. .13963
31. .08727
32. .26180
33. .14148
34. .52612
35. .79279
36. .72661
37. 132°21'11"
38. 95°41'2"
39. 33°13'53"
40. 41°15'10"
41. 125°28'39"
42. 42°23'56"
43. 0°20'38"
44. 0°24'4"
45. 8.8462, or 8.8 in.
46. 14.286, or 14 in.
47. $\sin \theta$
48. $-\cos \theta$
49. $\tan \theta$
50. $\cos \theta$
51. $-\sin \theta$
52. $-\operatorname{ctn} \theta$
53. $\operatorname{ctn} \theta$
54. $\cos \theta$
55. $\sin \theta$
56. $-\cos \theta$
57. $-\sin \theta$
58. $\operatorname{ctn} \theta$
59. $-\cos \theta$
60. $\sin \theta$
61. $-\operatorname{ctn} \theta$

Pages 147-148

1. 18.84, or 19
2. 43.354, or 43.4
3. 7.8305, or 7.83
4. 8.7854, or 8.79
5. 2.7 radians
6. 4.9693, or 5.0 radians
7. 37°14'32", or 37°
8. 69.047, or 69.05 miles
9. .138, or .14 radians, approx. 8°
10. 2.3562, or 2.4 cm.
11. 720 revolutions.
12. 52.892, or 52.89 miles
13. 48.823, or 48.82 miles

Pages 149-150

1. 600π radians per minute
2. 500 ft. per minute
3. 480π radians per minute
4. 1.5 seconds
5. 1500 revolutions per minute
6. 112 in. per second
7. 225 ft. per second
8. 62.5π, or 60π radians per second.

9. 25.893, or 26 in.
10. .85714, or .86 radians per second, approx. 49° per second.

Pages 151-152

1. $39\frac{1}{16}\pi$, or 39π sq. in.
2. 26.128, or 26.13 sq. in.
3. 108.27, or 110 sq.in.
4. 50.266, or 50 sq. in.
5. 29.43, or 29 sq. in.
6. 31.32, or 31 sq. in.
7. 5.8248, or 5.825 sq. in.
8. 307.81, or 307.8 sq. in.
9. 567.46, or 570 gallons
10. 14.70, or 15
11. 138.68, or 140 sq. in.
12. 1.3889, or 1.4 radians, approx. 80°

Pages 154-155

1. a. $71\frac{1}{9}$ mils. b. $355\frac{5}{9}$ mils. c. $213\frac{1}{3}$ mils. d. $1\frac{5}{27}$ mils.
2. a. 1°. b. 90°. c. 2°21'45".
3. a. 31 radians. b. 1 radian. c. 2 radians.
4. 1500 mils.
5. A radian.
6. 3°.
7. 6 mils.
8. 10,000 ft.
9. 5,000 ft.
10. $\frac{80}{9}$, or 9 mils.

Pages 155-156

1. Radian; degree.
2. An angle of an equilateral triangle.
3. a. $\frac{3\pi}{20}$. b. π. c. $\frac{\pi}{2}$. d. $\frac{\pi}{4}$.
4. a. 180°. b. 360°. c. 114°35'30". d. 45°.
5. a. $14\frac{2}{3}$, or 15. b. 578.05, or 578. c. 3.768, or 3.8.
6. 40.76, or 41 in.
7. $\frac{1}{4}$ unit.
8. a. 21°29'8", approx. b. 28°38'52", approx. c. 100°16'3", approx.
9. a. 25.12, or 25 in. b. 16.75, or 17 in. c. 6.70, or 6.7 in.
10. 6π radians
11. 50.756, or 51 in.
12. 240 rev. per minute
14. 251.20 ft. per second, approx.
15. 25 radians per second, approx.
16. a. $-\sin\theta$. b. $\operatorname{ctn}\theta$. c. $-\sin\theta$.
17. 8.9586, or 9.0 sq. in.

Page 159

2. CD represents the sine; OC, the cosine.

Page 161

1. Quadrants I - IV in order: OB, + - - +; OC, + - - +;
OE, + + - -; OD, + + + +.

2. Sine and tangent; cosine and cotangent.

3. Secant and cosecant.
4. Quadrant I.
5. sine.
6. tangent.
7. cosine.
8. reciprocal functions.
9. sine and cosine.
10. secant and cosecant.

11. tangent and cotangent; or secant and cosecant.

Pages 165-166

2. The tangent.

3. sine and cosine, -1 to +1; tangent and cotangent, $-\infty$ to $+\infty$; secant and cosecant, +1 to $+\infty$ and -1 to $-\infty$.

4. a. tan θ is greater. c. ctn θ is greater.
b. sec θ is greater. d. csc θ is greater.

5. a. 210°, 300°, 350°. b. 40°, 300°, 80°, 350°.
c. 40°, 210°, 80°.

8. The cotangent.

10. The sine, cosine, tangent, and cotangent.

11. a. IV. b. I and IV. c. II and III. d. None.

12. The tangent, cotangent, secant, and cosecant.

13. a. tan θ is greater. b. Neither is greater.

14. They are reciprocal functions.

Page 168

1. 0 to 1; +1 to -1; -1 to 0.

2. 0 to -1; increases from -1 to +1; decreases from 1 to 0.

3. repeats. 4. +1, -1. 5. .7, -1.

Page 169

1. It repeats itself. 2. 360° or 2π.

3. Decreases from 1 to -1; increases from -1 to 1.

5. 1; -1. 7. Yes.

Page 170

1. 0 to 1. 2. 1 to ∞. 3. $+\infty$ to $-\infty$. 4. 180°. 5. 180°.
6. -315°, -135°, 45°, 225°; -225°, -45°, 135°, 315°.
7. .25; -1.

Page 172

1. 360° or 2π; 360° or 2π. 2. $-\infty$; $+\infty$.
3. They have the same absolute value but are of opposite sign. One is slightly less than $+\infty$, and the other slightly more than $-\infty$.

Page 174

1. -5.5, -2.4, .8, 3.9, and 7.1 radians, approx.
2. -3.9, -.8, 2.4, and 5.5 radians, approx.
3. $-\pi$ and 0 radians, π and 2π radians; -2π and $-\pi$ radians, 0 and π radians.
4. $-\frac{\pi}{2}$ and $\frac{\pi}{2}$ radians, $\frac{3\pi}{2}$ and $\frac{5\pi}{2}$ radians; $-\frac{3\pi}{2}$ and $-\frac{\pi}{2}$ radians, $\frac{\pi}{2}$ and $\frac{3\pi}{2}$ radians.
5. Conclusion: The value of the cosine of any angle is the slope of the sine function at that angle.

Page 179

1. $\frac{2\pi}{3}$, 1. 2. π, 1. 3. π, 3. 4. $\frac{2\pi}{3}$, 4. 5. π, ∞.
6. $\frac{\pi}{3}$, ∞. 8. 1.
9. At point P, the increase in the function is equal to the increase in X.
11. 180°.
14. 427.53, or 430 meters. Note: Radio waves travel at 186,000 miles per second.
15. 1591.9, or 1590 kilocycles per second.

Page 180

1. a. True. b. False. c. True. d. True.
2. As x increases from 0° to 90°, cos x decreases from 1 to 0; from 90° to 180°, cos x decreases to -1; from 180° to 270°, cos x increases to 0; from 270° to 360°, cos x increases to 1.

3. As x increases from 0° to 90°, tan x increases from 0 to ∞; from 90° to 180°, tan x increases from -∞ to 0; from 180° to 270°, tan x increases from 0 to ∞; from 270° to 360°, tan x increases from -∞ to 0.

4. sine, tangent, secant; cosine, cotangent, cosecant.

5. sine and cosecant; tangent and cotangent; cosine and secant.

6. The same unit of measurement should be used on the x-axis and the y-axis to represent the angle and the function of the angle, respectively.

7. sine and cosine.

8. secant and cosecant.

9. tangent, cotangent, secant, and cosecant.

11. Horizontal line segments are positive to the right of the y-axis and negative to its left. Vertical line segments are positive above the x-axis and negative below it. The terminal side of the angle is positive.

12. Quadrant III. 13. Negative. 14. They are the same.

15. All quadrants; all quadrants. 16. 90° and 270°.

17. 30°, 274°, -40°.

18. a. False. b. True. c. True. d. True. e. True. f. False.

21. $\frac{3}{5}$; 180° or π. 22. 4; 1440° or 8π.

Page 187

1. $\sin \phi = \pm\sqrt{1 - \cos^2\phi}$

$\tan \phi = \pm\frac{\sqrt{1 - \cos^2\phi}}{\cos \phi}$

$\operatorname{ctn} \phi = \pm\frac{\cos \phi}{\sqrt{1 - \cos^2\phi}}$

$\sec \phi = \frac{1}{\cos\phi}$

$\csc \phi = \pm\frac{1}{\sqrt{1 - \cos^2\phi}}$

2. $\sin \phi = \pm\frac{\tan \phi}{\sqrt{\tan^2\phi + 1}}$

$\cos \phi = \pm\frac{1}{\sqrt{1 + \tan^2\phi}}$

$\operatorname{ctn} \phi = \frac{1}{\tan\phi}$

$\sec \phi = \pm\sqrt{1 + \tan^2\phi}$

$\csc \phi = \pm\frac{\sqrt{\tan^2\phi + 1}}{\tan \phi}$

3. $\sin \phi = \pm\frac{1}{\sqrt{1 + \operatorname{ctn}^2\phi}}$

$\cos \phi = \pm\frac{\operatorname{ctn} \phi}{\sqrt{\operatorname{ctn}^2\phi + 1}}$

$\tan \phi = \frac{1}{\operatorname{ctn}\phi}$

$\sec \phi = \pm\frac{\sqrt{\operatorname{ctn}^2\phi + 1}}{\operatorname{ctn} \phi}$

$\csc \phi = \pm\sqrt{1 + \operatorname{ctn}^2 \phi}$

4. $\sin \phi = \pm\frac{\sqrt{\sec^2\phi - 1}}{\sec \phi}$

$\cos \phi = \frac{1}{\sec\phi}$

$\tan \phi = \pm\sqrt{\sec^2\phi - 1}$

$\operatorname{ctn} \phi = \pm\frac{1}{\sqrt{\sec^2\phi - 1}}$

$\csc \phi = \pm\frac{\sec \phi}{\sqrt{\sec^2\phi - 1}}$

5. $\sin \phi = \frac{1}{\csc\phi}$

$\cos \phi = \pm\frac{\sqrt{\csc^2\phi - 1}}{\csc \phi}$

$\tan \phi = \pm\frac{1}{\sqrt{\csc^2\phi - 1}}$

$\operatorname{ctn} \phi = \pm\sqrt{\csc^2\phi - 1}$

$\sec \phi = \pm\frac{\csc \phi}{\sqrt{\csc^2\phi - 1}}$

6. 1.

7. $\cos^2\phi$

8. $\tan^2\phi$

9. 2

10. 1

11. 2 sin 20°

Pages 188-189

1. $\sin \theta$

2. $\frac{\cos^2 A}{\sin A}$

3. $\sec x$

4. $\csc x$

5. $\csc \theta$

6. $\cos^2 x$

7. $\frac{\sin x - 1}{\cos x}$

8. $\csc \theta$

9. $\frac{\cos^3\theta + \cos^2\theta - 1}{\sin \theta \cos \theta}$

10. $\operatorname{ctn} \theta$

11. $\sin^2 y$

12. $2 \sin \alpha \cos \alpha$

13. $\csc^2\beta$

14. $\sin^2 x$

15. 1

16. $\operatorname{ctn}^2\theta$

17. $\tan^2 A$

18. $1 + \sin \beta$

19. $2 \cos^2\theta - 1$

20. $\sin \alpha$

21. 1

22. $\sin \theta$

23. $\cos A - \sin A$

24. $1 - \cos \beta$

25. $\sin^2\phi$

Pages 196-197

1. 120°, 240°

2. 30°, 150°, 210°, 330°

3. 30°, 150°, 210°, 330°

4. 30°, 150°, 210°, 330°

5. 90°, 270°
6. 101°57', or 258°3'*
7. 30°, 210°
8. 0°, 180°
9. 45°, 135°, 225°, 315°
10. 0°, 45°, 180°, 225°
11. 120°, 300°
12. 41°25', 318°35'
13. 30°, 90°, 150°, 210°, 270°, 330°
14. 30°, 90°, 150°, 210°, 270°, 330°
15. 63°26', 116°34', 243°26', 296°34'
16. 75°58', 255°58'
17. 45°, 225°
18. 30°, 90°, 150°
19. 60°, 120°, 240°, 360°
20. 30°, 120°, 150°, 300°
21. 45°, 135°, 225°, 270°, 315°
22. 45°, 135°, 225°, 270°, 315°
23. 26°34', 153°26', 206°34', 333°26'
24. 53°8'
25. 90°, 199°28', 340°32'
26. No solution
27. 70°32', 289°28'
28. 9°0', 107°34', 189°0', 287°34'
29. 0°, 180°
30. 90°
31. 240°, 300°
32. 45°, 90°, 225°, 270°
33. 201°28', 338°32'
34. 30°, 150°, 210°, 330°
35. 30°, 150°, 210°, 330°
36. 45°, 135°, 225°, 315°
37. 90°, 180°
38. 45°
39. 90°, 330°
40. 75°58', 165°58', 255°58', 345°58'
41. 45°, 90°, 135°, 225°, 270°, 315°
42. 24°53', 155°7', 204°53', 335°7'
43. 67°30', 247°30', 157°29', 337°29'
44. 45°, 135°, 225°, 315°
45. 60°, 180°, 300°
46. 90°, 210°, 330°
47. 32°13', 212°13'
48. 120°, 240°

Page 198 (top)

1. $r = 0$, $\theta = 0°$ and 180°; $r = \sqrt{3}$, $\theta = 60°$; $r = -\sqrt{3}$, $\theta = 300°$.

2. $r = \frac{1}{2}$, $\theta = 60°$, and 300°.

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*Results which have been read from Table X are given to the nearest minute.

3. $r = .8944$, $\theta = 26°34'$; $r = -.8944$, $\theta = 206°34'$.
4. $r = .6180$, $\theta = 22°27'$, and $157°33'$.
5. $r = 2$, $\theta = 60°$, and $300°$; $r = -2$, $\theta = 120°$, and $240°$.
6. $r = 2$, $\theta = 75°58'$, and $255°58'$; $r = -6$, $\theta = 88°25'$, and $268°25'$.

Page 198

1. .45, approx.
2. 1.9, approx.
3. ±.82, approx.
4. .48, approx. Other solutions are possible.
5. 2.7, approx.
6. -1.3, 0, approx.

Pages 198-199

1. a. sin 84° c. tan 32° e. -sin 36° g. cos 27°
   b. -cos 78° d. ctn 46° f. -csc 5° h. -sec 80°

2. a. ctn 70° c. cos 60° e. -csc 80° g. -sec 25°
   b. tan 78° d. -sin 60° f. ctn 70° h. -sin 5°

3. a. 30° c. 120° e. 157°30' g. -120° i. -45°
   b. 135° d. 150° f. 900° h. 210° j. 114°36'

4. a. $\frac{3\pi}{4}$. b. $\frac{7\pi}{6}$. c. $\frac{2\pi}{3}$. d. $\frac{\pi}{12}$. e. $\frac{3\pi}{2}$.

5. a. sin θ c. -ctn θ e. -cos θ g. -csc θ i. -cos θ
   b. -cos θ d. tan θ f. -csc θ h. -cos θ

6. .3170, or .3 sq. units.
7. 2210.56, or 2000 ft. per minute.
8. 6.
9. 1.0986, approx.
10. 3.729, approx.
11. 2.
12. .44211, approx.
13. ±1.3170, approx.
14. 50.75, or 50 feet.
15. $B = 56°43'$; $a = 41.817$, or 41.8 ft.; $c = 76.20$, or 76.2 ft.
16. 3.8044 in., approx.

Pages 204-205

1. $\frac{1}{4}(\sqrt{6} + \sqrt{2})$, $\frac{1}{4}(\sqrt{2} - \sqrt{6})$, $-2 - \sqrt{3}$.

2. $\frac{1}{4}(\sqrt{6} - \sqrt{2})$, $\frac{1}{4}(\sqrt{6} + \sqrt{2})$, $2 - \sqrt{3}$.

4. a. $\frac{1}{2}(\cos A + \sqrt{3} \sin A)$

b. $\frac{1}{2}\sqrt{2}(\cos A - \sin A)$

c. $\dfrac{\sqrt{3} + 4 \tan A + \sqrt{3} \tan^2 A}{1 - 3 \tan^2 A}$

d. $\dfrac{3\sqrt{3} - 12 \tan A + 3\sqrt{3} \tan^2 A}{9 - 3 \tan^2 A}$

e. $\frac{1}{2}\sqrt{2}(\cos A - \sin A)$

f. $\frac{1}{2}(\cos A + \sqrt{3} \sin A)$

g. $\sqrt{3} \sin B$

h. $\sqrt{3} \cos B - \sin B$

i. 0

j. 0

k. $\cos(A + B) - \sqrt{3} \sin(A + B)$

5. a. $-\frac{21}{221}, \frac{220}{221}, -\frac{21}{220}$

b. $\frac{171}{221}, \frac{140}{221}, \frac{171}{140}$

c. $\frac{5}{13}, \frac{12}{13}, \frac{5}{12}$

d. $\frac{8}{17}, \frac{15}{17}, \frac{8}{15}$

6. $-\frac{4}{3}$.

7. a. $-\frac{4}{5}$. b. $\frac{3}{5}$. c. $\frac{44}{117}$. d. $= \frac{44}{125}$.

8. a. sin 55°. b. sin 30°. c. cos 50°. d. tan 65°.

12. $\frac{1}{2}(\sin(\theta - A) + \frac{1}{2}\sqrt{3} \cos(\theta - A)$.

13. a. $\sin \theta$. b. $\cos \alpha$.

14. 3.

15. 1.

Pages 208-209

1. $\sin 15° = \frac{1}{2}\sqrt{2 - \sqrt{3}}$

$\cos 15° = \frac{1}{2}\sqrt{2 + \sqrt{3}}$

$\tan 15° = 2 - \sqrt{3}$

2. $\sin 75° = \frac{1}{2}\sqrt{2 + \sqrt{3}}$

$\cos 75° = \frac{1}{2}\sqrt{2 - \sqrt{3}}$

$\tan 75° = 2 + \sqrt{3}$

3. a. $\sin 2\theta = \frac{24}{25}$

$\cos 2\theta = -\frac{7}{25}$

$\tan 2\theta = -\frac{24}{7}$

b. $\sin \frac{1}{2}\theta = \frac{1}{5}\sqrt{5}$

$\cos \frac{1}{2}\theta = \frac{2}{5}\sqrt{5}$

$\tan \frac{1}{2}\theta = \frac{1}{2}$

4. a. $\sin 60° = \frac{1}{2}\sqrt{3}$

$\cos 60° = \frac{1}{2}$

$\tan 60° = \sqrt{3}$

b. $\sin 120° = \frac{1}{2}\sqrt{3}$

$\cos 120° = -\frac{1}{2}$

$\tan 120° = -\sqrt{3}$

c. $\sin 240° = -\frac{1}{2}\sqrt{3}$

$\cos 240° = -\frac{1}{2}$

$\tan 240° = \sqrt{3}$

d. $\sin 300° = -\frac{1}{2}\sqrt{3}$

$\cos 300° = \frac{1}{2}$

$\tan 300° = -\sqrt{3}$

5. a. $\sin 22\frac{1}{2}° = \frac{1}{2}\sqrt{2 - \sqrt{2}}$

$\cos 22\frac{1}{2}° = \frac{1}{2}\sqrt{2 + \sqrt{2}}$

$\tan 22\frac{1}{2}° = \sqrt{2} - 1$

b. $\sin 105° = \frac{1}{2}\sqrt{2 + \sqrt{3}}$

$\cos 105° = -\frac{1}{2}\sqrt{2 - \sqrt{3}}$

$\tan 105° = -2 - \sqrt{3}$

c. $\sin 67\frac{1}{2}° = \frac{1}{2}\sqrt{2 + \sqrt{2}}$

$\cos 67\frac{1}{2}° = \frac{1}{2}\sqrt{2 - \sqrt{2}}$

$\tan 67\frac{1}{2}° = \sqrt{2} + 1$

d. $\sin 150° = \frac{1}{2}$

$\cos 150° = -\frac{1}{2}\sqrt{3}$

$\tan 150° = -\frac{1}{3}\sqrt{3}$

8. a. $\sin 2\theta = \frac{336}{625}$

b. $\cos 2\theta = \frac{527}{625}$

c. $\tan 2\theta = \frac{336}{527}$

d. $\cos \frac{1}{2}\theta = -\frac{1}{10}\sqrt{2}$

e. $\tan \frac{1}{2}\theta = -7$

9. a. $\sin 2\theta = -\frac{240}{289}$

b. $\tan 2\theta = \frac{240}{161}$

c. $\tan \frac{1}{2}\theta = \frac{5}{3}$

d. $\sin \frac{1}{2}\theta = \frac{5}{34}\sqrt{34}$

e. $\cos \frac{1}{2}\theta = \frac{3}{34}\sqrt{34}$

10. a. $\tan 2\theta = -\frac{4}{3}$

b. $\tan \frac{1}{2}\theta = -\frac{1}{2}(\sqrt{5} + 1)$

c. $\sin 2\theta = \frac{4}{5}$

d. $\cos 2\theta = -\frac{3}{5}$

e. $\cos \frac{1}{2}\theta = -\frac{1}{10}\sqrt{10(5 - \sqrt{5})}$

11. a. $3 \sin \theta - 4 \sin^3\theta$

b. $4 \cos^3\theta - 3 \cos \theta$

c. $\frac{\tan \theta(3 - \tan^2\theta)}{1 - 3 \tan^2\theta}$

d. $4\sqrt{1 - \sin^2\theta}(\sin \theta - 2 \sin^3\theta)$

Page 211

1. $\sin 8A - \sin 4A$
2. $\cos 8A + \cos 2A$
3. $\cos \phi - \cos 5\phi$
4. $\frac{1}{2}(\sin 5\alpha + \sin 3\alpha)$
5. $\frac{1}{2}(\sin 6\beta + \sin 2\beta)$
6. $\frac{1}{2}(\sin x + \sin \frac{1}{2}x)$
7. $\frac{1}{2}(\sin \frac{3}{2}\theta - \sin \frac{1}{2}\theta)$
8. $\frac{1}{2}(\sin 2\phi + \sin \phi)$
9. $\frac{1}{2}(\cos 2z - \cos 6z)$
10. $2 \sin 3\theta \cos \theta$
11. $-2 \sin 4\theta \sin \theta$
12. $2 \cos 4\theta \sin 2\theta$
13. $2 \cos 2\alpha \cos \alpha$
14. $-2 \cos 4\beta \sin \beta$
15. $-2 \sin \phi \sin \frac{1}{2}\phi$
16. $2 \cos \frac{3}{2}\theta \cos \frac{1}{2}\theta$
17. $2 \sin 3\theta \cos 2\theta$
18. $2 \cos A \sin \frac{1}{2}A$
19. $\frac{1}{2}\sqrt{6}$
20. $\frac{1}{4}(\sqrt{6} - \sqrt{2})$
21. $-\frac{1}{2}\sqrt{2}$

Pages 216-217

1. $x = 0°, 180°$
2. $\alpha = 30°, 90°, 150°, 270°$
3. $\beta = 60°, 300°$
4. $\phi = 0°, 120°, 180°, 240°$
5. $\theta = 26°34', 90°, 206°34', 270°$
6. $x = 45°, 161°34', 225°, 341°34'$
7. $y = 0°, 45°, 135°, 180°, 225°, 315°$
8. $z = 0°, 90°, 180°, 270°$
9. $\phi = 30°, 150°, 210°, 330°$
10. $\theta = 120°, 240°$
11. $x = 36°52', 143°8', 216°52', 323°8'$
12. $\theta = 0°, 120°, 240°$
13. $A = 0°, 30°, 150°, 180°$
14. $\phi = 18°, 54°, 126°, 162°, 198°, 234°, 306°, 342°$
15. $\alpha = 30°, 150°, 210°, 330°$
16. $\beta = 45°, 135°, 210°, 225°, 315°, 330°$
17. $x = 30°, 90°, 150°, 210°, 270°, 330°$
18. $\theta = 120°, 240°$
19. $\phi = 0°, 15°, 75°, 90°, 105°, 165°, 180°, 195°, 255°, 270°, 285°, 345°$
20. $z = 45°, 120°, 135°, 150°, 225°, 300°, 315°, 330°$

21. $\theta = 30°, 60°, 120°, 150°, 210°, 240°, 300°, 330°$
22. $y = 0°, 90°, 120°, 240°, 270°$
23. $\theta = 135°, 315°$
24. $x = 60°, 120°, 240°, 300°$
25. $A = 0°, 60°, 120°, 180°, 240°, 300°$
26. $\theta = 15°, 32°57', 57°3', 75°, 105°, 122°57', 147°3', 165°, 195°, 212°57', 237°3', 255°, 285°, 302°57', 327°3', 345°$
27. $\phi = 90°, 270°$
28. $z = 120°, 240°$
29. $y = 0°, 60°, 120°, 180°, 240°, 300°$
30. $x = 0°, 45°, 135°, 225°, 315°$
31. $\alpha = 0°, 60°, 90°, 120°, 180°, 240°, 270°, 300°$
32. $\theta = 15°, 75°, 195°, 255°$
33. $y = 0°, 60°, 120°, 135°, 180°, 240°, 300°, 315°$
34. $x = 30°, 150°, 270°$
35. No solution
36. $\theta = 35°26', 84°34', 155°26', 204°34', 275°26', 324°34'$
37. $\phi = 60°, 90°, 300°$
38. $y = 0°, 180°, 220°39', 319°21'$
39. $x = 90°, 270°$
40. $A = 0°, 74°5', 127°25', 180°, 232°35', 285°55'$

Page 224

1. $A = 61°45'$
   $b = 30.510$, or 30.51
   $c = 23.433$, or 23.43

2. $A = 62°10'$
   $b = 1.8625$, or 1.862
   $c = 1.6968$, or 1.697

3. $C = 58°00'$
   $a = 1.1617$, or 1.162
   $c = 1.2814$, or 1.281

4. $C = 86°20'$
   $a = 4.7558$, or 4.756
   $c = 5.5205$, or 5.520

5. $B = 75°10'55''$
   $a = 7.2583$
   $c = 5.3846$

6. $B = 109°59'40''$
   $a = 1.7450$
   $b = 5.1899$

7. $A = 65°55'$
   $a = 937.88$, or 937.9
   $b = 235.46$, or 235.5

8. $B = 52°26'$
   $b = 11.331$, or 11.33
   $c = 6.5268$, or 6.527

9. $C = 67°54'$
   $b = 4.7673$, or 4.767
   $c = 7.9472$, or 7.947

Pages 229-231

1. Case IIA. One solution.
2. Case IIB (1). No solution
3. Case IIC (1). No solution
4. Case IIA. One solution
5. Case IIC (2). Two solutions
6. Case IIC (2). No solution
7. Case IIC (2). One solution
8. Case IIC (2). Two solutions
9. Case IIB (2). One solution

10. B = 43°35'32", or 43°36'
    C = 62°6'28", or 62°6'
    c = 21.547, or 21.55

11. B = 37°18'25", or 37°18'
    C = 98°16'35", or 98°17'
    c = 5.9188, or 5.919

12. (Two solutions.)
    A = 81°52'20", or 81°52'
    B = 63°44'40", or 63°45'
    a = 41.107, or 41.11

    A' = 29°21'40", or 29°22'
    B' = 116°15'20", or 116°15
    a' = 20.360, or 20.36

13. (Two solutions.)
    B = 35°9'57", or 35°10'
    C = 123°7'3", or 123°7'
    c = 76.260, or 76.26

    B' = 144°50'3", or 144°50'
    C' = 13°26'57", or 13°27'
    c' = 21.176, or 21.18

14. No solution.

15. A = 36°48'15", or 36°48'
    C = 32°29'0", or 32°29'
    a = 10.978, or 10.98

16. 23.431, or 23.43 ft.; 25.966, or 25.97 ft.

17. 5.0049, or 5.00 in.

18. 47°22'30", or 47°

19. 239,430 miles; 239,380 miles. To four places, they are each 239,400 miles.

20. 7.7742, or 7.8 miles

21. 20.026, or 20 miles.

22. 484.1, or 480 m.p.h.

Page 233

1. A = 88°10', or 88°
   B = 45°33', or 46°
   c = 10.13, or 10

2. A = 41°38', or 42°
   B = 27°43', or 28°
   c = 28.17, or 28

3. B = 59°34', or 60°
   C = 43°37', or 44°
   a = 28.23, or 28

4. B = 72°12', or 72°
   C = 45°34', or 46°
   a = 59.48, or 59

5. B = 93°17', or 93°
   C = 41°44', or 42°
   a = 21.25 or 21

6. A = 45°24', or 45°
   B = 62°52', or 63°
   c = 42.69, or 43

Page 234

1. A = 82°49', or 83°
   B = 41°25', or 41°
   C = 55°46', or 56°

2. A = 34°2', or 34°
   B = 44°25', or 44°
   C = 101°32', or 102°

3. A = 48°11', or 48°
   B = 58°25', or 58°
   C = 73°24', or 73°

4. A = 16°16', or 16°
   B = 73°44', or 74°
   C = 90°

5. A = 28°5'
   B = 61°56', or 62°0'
   C = 90°0'

6. A = 82°47', or 82°50'
   B = 42°5', or 42°10'
   C = 55°8', or 55°10'

Page 237

1. A = 46°45'43", or 46°50'
   B = 66°40'17", or 66°40'
   c = 512.59, or 513

2. A = 55°40'48", or 55°40'
   B = 41°24'12", or 41°20'
   c = 94.080 or 94.1

3. B = 35°37'26", or 35°37'
   C = 70°55'34", or 70°56'
   a = 76.262, or 76.26

4. B = 35°21'14", or 35°20'
   C = 110°13'46", or 110°10'
   a = 5.0960, or 5.10

5. A = 25°48'28", or 25°48'
   B = 32°41'32", or 32°42'
   c = 38.738, or 38.74

6. A = 24°14'12", or 24°14'
   C = 15°5'48", or 15°6'
   b = 71.597, or 71.60

7. B = 89°51'51", or 89°51'50"
   C = 47°49'29", or 47°49'30"
   a = 48.563

8. B = 48°33'59", or 48°34'0"
   C = 52°58'45"
   a = 116.20

9. A = 37°31'42", or 37°31'40"
   C = 48°11'38", or 48°11'40"
   b = 45.774

Page 242

1. A = 73°31'36", or 73°30'
   B = 56°32'0", or 56°30'
   C = 49°56'14", or 50°0'

2. A = 50°17'18", or 50°20'
   B = 88°15'26", or 88°10'
   C = 41°27'6", or 41°30'

3. A = 63°57'38", or 63°58'
   B = 43°22'6", or 43°22'
   C = 72°40'14", or 72°40'

4. A = 20°23'36", or 20°24'
   B = 56°38'58", or 56°39'
   C = 102°57'32", or 102°58'

5. A = 28°4'50", or 28°5'
   B = 62°14'50", or 62°15'
   C = 89°40'18", or 89°40'

6. A = B = 51°27'56", or 51°28'
   C = 77°4'4", or 77°4'

7. A = 103°18", or 103°0'
   B = 44°4'4", or 44°4'
   C = 32°55'42", or 32°56'

8. A = 22°33'0", or 22°33'
   B = 67°24'30", or 67°24'
   C = 90°2'18", or 90°2'

9. A = 78°36'50", or 78°37'
   B = 61°6'8", or 61°6'
   C = 40°17'4", or 40°17'

Page 243 (top)

1. C = 46°47'
   a = 164.27, or 164.3
   b = 149.81, or 149.8

2. A = 61°34'52", or 61°30'
   B = 22°58'8", or 23°0'
   a = 16.114, or 16.1

3. B = 24°17'16", or 24°17'
   C = 115°27'44", or 115°28'
   c = 33.761, or 33.76

4. A = 74°43'32", or 74°44'
   B = 52°55'28", or 52°55'
   c = 60.604, or 60.60

5. A = 52°3'21", or 52°3'20"
   B = 103°37'51", or 103°37'50"
   c = 8.0266

6. A = 73°13'24", or 73°13'25"
   B = 48°4'10"
   C = 58°42'32", 58°42'30"

Pages 243-246

1. 14.694, or 14.69 ft.; 8.8646, or 8.865 ft.

2. S18°54'52"W, or S19°W.

5. 74.885, or 75 ft.

6. 27.668, or 27.67 in.

7. 191.31, or 191 miles

8. 86°20'48", or 86°

9. 7.889, or 7.9 ft.

10. 219.02, or 220 m.p.h.

11. 748.27, or 748.3 ft.

13. 101°5'52", or 101°
14. 18.473, or 18
15. 33.230, or 33
16. 5515.7, or 5500 ft.
17. 3067.7, or 3068 ft.
18. 17,933, or 18,000 ft.

Pages 249-251

1. 1112.8, or 1100 sq.units
2. 12,161, or 12,200 sq.units
3. 192.88, or 193 sq.units
4. 4,715,500, or 5,716,000 sq.units
5. 2819.1, or 2819 sq.units
6. 10.213, or 10.21 sq.units
7. 14,109, or 14,110 sq.units
8. 187,038, or 187,040 sq.units
9. 2786.3 sq.units
10. 229.84, or 229.8 sq.ft.
11. 11,735, or 12,000 sq.units
12. 891.32, or 890 sq.units
13. 5.2916, or 5.3
14. 10.136, or 10
15. 6.5, or 6
16. 17.32, or 17 in.
17. 1.7537, or 1.754 acres
18. 11.213, or 11
19. 40 chains
20. 34°34'57", or 34°30'
21. 80.59, or 81 sq.ft.
22. 361.02, or 360 sq.in.
23. 8.99, or 9.0 sq.ft.
24. 509.21, or 510 sq.in.
25. 133.41, or 133.4 sq.in.
26. 7.80 in.
27. 8.294, or 8.3 sq.in.
28. 31.23, or 30 sq.units
32. 47.96, or 48 sq.yd.
33. 20,405, or 20,400 sq.ft.

Pages 256-258

1. 12.806, or 10 lb.; 51°20', or 50°; 38°40', or 40°.
2. 200 lb.; 36°52', or 36°50'; 53°8'.
3. 670.43, or 670 lb.; 20°2'48", or 20'; 24°57'12", or 25°.
4. 18.48, or 18 lb.
5. 1373.7, or 1400 lb.; 947.3, or 950 lb.
6. 601.41, or 600 lb.
7. 2771.2, or 2800 lb.
8. 13.107, or 13 lb.
9. 26.46, or 26 lb.; 48°36', or 49°.
10. 97°11'22", or 97°.
12. 180°.
14. 49.906, or 49.9 lb.; 204.0, or 204 lb.
15. 319.24, or 320 lb.; 52°53'59", or 52°50'.
16. 8.66; or 8.7 lb.; 5 lb.

Pages 262-263

1. 3.92, or 3.9 m.p.h.
2. 69.56, or 70 ft. per second.
3. 86°12'9", or 86°; 181.17, or 180 knots.
4. 233°46'54", or 233°; 233.89, or 234 knots.
5. 0°; 335 knots.
6. 104°22'24", or 100°.
7. 3°8'32", or 3°9'.
8. 160°3'54", or 160°
9. 39.48, or 39 m.p.h.; 185°11'48", or 190°.
10. 37°9'12", or 37°.
11. 13°24'15", or 13°.
12. 57.867, or 58 knots.
13. 58.304, or 58 m.p.h.

Pages 263-264

1. Case I: two angles and a side.
   Case II: two sides and an angle opposite one of them.
   Case III: two sides and their included angle.
   Case IV: three sides.
2. Case I: Mollweide's formula or $a = b \cos C + c \cos B$.
   Case II and III: Mollweide's formula.
   Case IV: $A + B + C = 180°$.
3. Cases I, II, and III.
4. See pages 220, 231, and 235 of the text.
5. a. side. b. angle.
7. $\frac{a - b}{c} = \frac{\sin \frac{1}{2}(A - B)}{\cos \frac{1}{2}C}$.
8. Yes. Case IIA.
9. One. Case IIC(2)(b).
10. 13.640, or 14.
11. 46°34'6", or 47°.
12. Acute.
13. 16.507, or 17 in.
14. 418.28, or 420 sq.in.
15. 646.36, or 646 sq.in.
16. A = C = 63°26'6"; B = 53°7'48".
17. 9.511, or 9.5 in.
18. 1073.6, or 1100 sq.in.
19. B = 39°54'8", or 40°; C = 65°53'52", or 66°; C = 119.53, or 120.

20. A = 62°41'0"; C = 49°54'20"; b = 332.68.

21. A = 52°29'12", or 52°29'; B = 56°31'52", or 56°32'; C = 70°58'54", or 70°59'.

22. 6.4550, or 6.5

23. 8.5

24. 10.248, or 10 in.

25. 268.416, or 270 m.p.h.

26. 113°30'27", or 114°; 229.47, or 230 m.p.h.

27. 317°33', or 318°.

28. 64.7, or 65 m.p.h.

29. They will meet.

30. 2554.9, or 2555 lbs.

31. 221.27, or 220 lbs.

32. 120 sin θ ft. per second.

Page 267

1. 45°, 225°

2. 30°, 150°, 210°, 330°

3. 150°, 330°

4. 135°, 225°

5. 60°, 300°

6. 45°, 135°, 225°, 315°

7. 180°

8. 135°, 315°

9. 45°, 315°

10. 48°11', 311°49'

11. 1°, 179°

12. 176°, 356°

13. $x = \frac{1}{2}$ arc sin y

14. $x = \frac{1}{4}$ arc tan 2y

15. $x = \frac{1}{2}$ arc sec $\frac{1}{2}$y

16. $x = \frac{1}{\pi}$ arc tan (y - 1).

17. $x = \frac{1}{5}$ cos y

18. $x = 2$ sin y

19. $x = \frac{1}{2}$ ctn $\frac{y}{2}$

20. $x = \frac{1}{4}$ sec y

21. $x = \frac{1}{5}$ csc $\frac{3}{4}y$

22. $r = \sqrt{y^2 + 1}$

θ = arc sin $\frac{y}{\sqrt{y^2 + 1}}$

θ = arc cos $\frac{1}{\sqrt{y^2 + 1}}$

θ = arc csc $\frac{\sqrt{y^2 + 1}}{y}$

θ = arc sec $\sqrt{y^2 + 1}$

θ = arc ctn $\frac{1}{y}$

23. $\theta = \arccos \frac{\sqrt{x(-x-2)}}{1}$

$\theta = \arctan \frac{x+1}{\sqrt{x(-x-2)}}$

$\theta = \operatorname{arc\,ctn} \frac{\sqrt{x(-x-2)}}{x+1}$

$\theta = \operatorname{arc\,sec} \frac{1}{\sqrt{x(-x-2)}}$

$\theta = \operatorname{arc\,csc} \frac{1}{x+1}$

24. $\theta = \arcsin \sqrt{x(2-x)}$

$\theta = \arctan \frac{\sqrt{x(2-x)}}{x-1}$

$\theta = \operatorname{arc\,ctn} \frac{x-1}{\sqrt{x(2-x)}}$

$\theta = \operatorname{arc\,sec} \frac{1}{x-1}$

$\theta = \operatorname{arc\,csc} \frac{1}{\sqrt{x(2-x)}}$

25. $\theta = \arcsin \sqrt{1-x^2}$

$\theta = \arccos x$

$\theta = \operatorname{arc\,ctn} \frac{x}{\sqrt{1-x^2}}$

$\theta = \operatorname{arc\,sec} \frac{1}{x}$

$\theta = \operatorname{arc\,csc} \frac{1}{\sqrt{1-x^2}}$

26. $\theta = \arcsin \frac{2a}{a^2+1}$

$\theta = \arccos \frac{a^2-1}{a^2+1}$

$\theta = \arctan \frac{2a}{a^2-1}$

$\theta = \operatorname{arc\,ctn} \frac{a^2-1}{2a}$

$\theta = \operatorname{arc\,csc} \frac{a^2+1}{2a}$

27. $\theta = \arccos \sqrt{1-e^{2x}}$

$\theta = \arctan \frac{e^x}{\sqrt{1-e^{2x}}}$

$\theta = \operatorname{arc\,ctn} \frac{\sqrt{1-e^{2x}}}{e^x}$

$\theta = \operatorname{arc\,sec} \frac{1}{\sqrt{1-e^{2x}}}$

$\theta = \operatorname{arc\,csc} \frac{1}{e^x}$

28. $\theta = \arcsin \frac{m-1}{\sqrt{2(m^2+1)}}$

$\theta = \arccos \frac{m+1}{\sqrt{2(m^2+1)}}$

$\theta = \arctan \frac{m-1}{m+1}$

$\theta = \operatorname{arc\,sec} \frac{\sqrt{2(m^2+1)}}{m+1}$

$\theta = \operatorname{arc\,csc} \frac{\sqrt{2(m^2+1)}}{m-1}$

Pages 268-269

1. 45°
2. 60°
3. -45°
4. 30°
5. -135°
6. 30°
7. -30°
8. 180°
9. -60°
10. 135°
11. 60°
12. -135°

13. 60°
14. 0°
15. -45°
16. 63°26'
17. 0°
18. Impossible
19. 2
20. $-\frac{\sqrt{2}}{2}$
21. $\frac{\sqrt{2}}{2}$
22. -1
23. $\frac{\sqrt{3}}{3}$
24. -2

Pages 273-274

1. $\frac{1}{6}(2 + \sqrt{15})$
2. $\frac{1}{10}(4\sqrt{3} + 3)$
3. 3
4. -8

Exercises 19, 20, and 21 are identities.

22. $x = 2$
23. $x = \frac{1}{6}$
24. $x = 1$
25. $x = \frac{1}{2}$
26. $x = \frac{1}{2}$
27. Impossible
28. $x = \sqrt{3}$
29. $x = \sqrt{3}$
30. $x = .4472$
31. $x = \frac{1}{5}$
32. $x = \pm 1$

Pages 279-280

1. $3 - 4i$
2. $-2 - i$
3. $7 + i\sqrt{3}$
4. $-2 - i\sqrt{5}$
5. $\sqrt{3} - i$
6. $x - iy$
7. $4i$
8. $i\sqrt{5}$
9. $2i\sqrt{2}$
10. $3ai\sqrt{3}$
11. $15i$
12. $16i\sqrt{2}$
13. $22i\sqrt{3}$
14. $7 - i$
15. $4i\sqrt{5}$
16. -6
17. $-\frac{2}{3}$
18. $-1 + 3i$
19. $-13i$
20. $\frac{11 - 2i}{5}$
21. $\frac{\sqrt{10} - 1 + i(\sqrt{2} + \sqrt{5})}{3}$
22. $-1 + 4i\sqrt{3}$
23. $7 + 6i\sqrt{2}$
24. $x^2 + y^2$
25. $2 - 11i$
26. $x = -2;\quad y = 3$
27. $x = \sqrt{3};\quad y = -3$
28. $x = 4;\quad y = 0$
29. $x = 0;\quad y = 4$
30. $-\sqrt{3} + 2i;\quad \sqrt{3} - 2i$
31. $-5 + i\sqrt{2};\quad 5 - i\sqrt{2}$
32. $-1 + i,\ 1 - i$
33. $x = \pm 2i\sqrt{3}$
34. $x = \pm\frac{3}{2}i$
35. $x = \frac{-1 \pm i\sqrt{3}}{2}$
36. $x = 1 \pm i$
37. $x = 1;\quad x = \frac{-1 \pm i\sqrt{3}}{2}$

Page 281

13. $7 + 7i$
14. $1 + 10i$
15. $2 + 6i$
16. $4 - 3i$
17. $1 + 8i$
18. $3 - 2i$

Page 284

1. $r \text{ cis } \theta = \sqrt{2} \text{ cis } 45°$
2. $r \text{ cis } \theta = \sqrt{13} \text{ cis } 236°19'$
3. $r \text{ cis } \theta = \sqrt{29} \text{ cis } 68°12'$
4. $r \text{ cis } \theta = (\sqrt{3} - 1) \text{ cis } 0°$
5. $r \text{ cis } \theta = \sqrt{13} \text{ cis } 146°19'$
6. $r \text{ cis } \theta = 6 \text{ cis } 30°$
7. $r \text{ cis } \theta = 4 \text{ cis } 180°$
8. $r \text{ cis } \theta = 3 \text{ cis } 90°$
9. $3\sqrt{3} + 3i$
10. $\frac{5\sqrt{3}}{2} - \frac{5}{2}i$
11. $-3i$
12. $-4 + 4i\sqrt{3}$
13. $-2\sqrt{3} - 2i$
14. $\frac{9\sqrt{3}}{2} - \frac{9}{2}i$
15. 2
16. -5

Page 287

1. -6
2. $20 \text{ cis } 65°$
3. $3i$
4. -3
5. $4\sqrt{2} \text{ cis } 375°$
6. $5 \text{ cis } 233°7'36"$
7. $2\sqrt{2} \text{ cis } 135°$, or $-2 + 2i$
8. $7 \text{ cis } 638°12'50"$
9. $243 \text{ cis } 450°$, or $243i$
10. $64 \text{ cis } 1260°$, or -64
11. $64 \text{ cis } 1980°$, or -64
12. $32 \text{ cis } 1500°$
13. $2^{\frac{1}{8}} \text{ cis } 11°15'$
14. $2^{\frac{1}{10}} \text{ cis } 63°$
15. $2^{\frac{3}{8}} \text{ cis } 33°45'$
16. $(2\sqrt{3})^{\frac{1}{6}} \text{ cis } 55°$
17. $3 \text{ cis } 0°$; $3 \text{ cis } 120°$; $3 \text{ cis } 240°$
18. $4 \text{ cis } 60°$; $4 \text{ cis } 180°$; $4 \text{ cis } 300°$
19. $2 \text{ cis } 0°$; $2 \text{ cis } 120°$; $2 \text{ cis } 240°$
20. $\sqrt{5} \text{ cis } 26°34'$
21. $(3\sqrt{2})^{\frac{1}{2}} \text{ cis } 80°16'$

22. $x = 2i, -2i$.

23. $x = 1, .7071 + .7071i, i, -.7071 + .7071i, -1, -.7071 - .7071i, -i, .7071 - .7071i$.

24. $x = 2, -1 + i\sqrt{3}, -1 - i\sqrt{3}$.

25. $x = \frac{\sqrt{3}}{2} - \frac{1}{2}i, -\frac{\sqrt{3}}{2} - \frac{1}{2}i, \quad i.$

26. $x = \sqrt[4]{8}(1 \pm i), \sqrt[4]{8}(-1 \pm i).$

27. x = .8090 + .5878i, -.3090 + .9511i, -1, -.3090 - .9511i, .8090 - .5878i.

28. $x = 1, \frac{1}{2} + i\frac{\sqrt{3}}{2}, -\frac{1}{2} + i\frac{\sqrt{3}}{2}, -1, -\frac{1}{2} - i\frac{\sqrt{3}}{2}, \frac{1}{2} - i\frac{\sqrt{3}}{2}.$

29. $x = \frac{3}{2} + i\frac{3\sqrt{3}}{2}, -3, \frac{3}{2} - i\frac{3\sqrt{3}}{2}.$

30. $x = \pm\sqrt[4]{8}, \pm i\sqrt[4]{8}.$

Pages 290-291

Note: In Ex. 1-5, the first value given is that computed; the second value is that found in Table X.

1. .8333; .8415
2. .5477; .5404
3. 1.522; 1.558
4. .4792; .4794
5. .8776; .8775
6. 2.71

29. x = 0, 0.69315

30. x = 0.69315

Pages 292-293

True: 1, 3, 5, 6, 7, 8, 10, 12, 13, 16, 18, 19, 20.

False: 2, 4, 9, 11, 14, 15, 17.

21. 0.55205 22. 2.7×10^{-5} 23. $10^{4.24206}$ 24. 100 25. 100

26. $\cos x = \frac{\sqrt{7}}{4}$; $\tan x = \frac{3\sqrt{7}}{7}$; $\operatorname{ctn} x = \frac{\sqrt{7}}{3}$; $\sec x = \frac{4\sqrt{7}}{7}$; $\csc x = \frac{4}{3}$.

27. 1.3010

28. 3.1024, or 3.10

29. 893.66, or 894

30. 8.9208, or 8.921

31. x = 5

32. x = 6.1699, approx.

33. x = 1

34. x = 1581.1, approx.

35. x = 10

36. A = 28°28'; a = 133.4; c = 280.0

37. B = 57°41'; a = 8.489; c = 15.88

38. B = 48°42'; a = 118.3; b = 134.7

39. A = 30°51'; B = 59°9'; b = 337.1

Pages 293-295

1-10. True: 1, 2, 3, 4, 7. False: 5, 6, 8, 9, 10.

11. $\sin A = -\frac{3\sqrt{10}}{10}$; $\cos A = -\frac{\sqrt{10}}{10}$; $\tan A = 3$; $\sec A = -\sqrt{10}$; $\csc A = -\frac{\sqrt{10}}{3}$.

12. $\sin \theta = -\frac{\sqrt{2}}{2}$; $\tan \theta = -1$; $\operatorname{ctn} \theta = -1$; $\sec \theta = \sqrt{2}$; $\csc \theta = -\sqrt{2}$.

13. a. sin 45° d. -ctn 50° g. -csc 19°48'
b. -cos 10° e. -sec 30° h. sin 62°47'
c. -tan 20° f. -cos 68° i. -tan 15°23'

14. a. sin θ d. -tan θ g. -sin θ
b. -sin θ e. -sec θ h. cos θ
c. -ctn θ f. -sec θ i. -tan θ

15. 45°

16. .1906π radians.

17. 9.5554, or 9.555 in.

18. -sin θ

19. -cos θ

20. ctn θ

21. cos θ

22. 471.24 ft. per second, approx.

23. A = 62°59'15"; B = 27°0'45"; c = 517.81.

24. B = 43°41'20"; b = 22.427; c = 32.468.

25. 15,149, or 15,150 sq.units.

26. 361.99 sq.units.

27. 94.598, or 94.60 sq.units

28. 3.

29. 20π radians.

30. a. 45°. b. 3°36'. c. 18°.

31. a. 142.2 mils. b. 213.3 mils. c. 711.1 mils.

32. Yes.

33. 30°.

*34. a. 0, 1, 0
b. 0, -1, 0
c. $\frac{1}{2}, \frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{3}$
d. $\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, 1$
e. $\frac{\sqrt{3}}{2}, \frac{1}{2}, \sqrt{3}$
f. $-\frac{\sqrt{3}}{2}, -\frac{1}{2}, \sqrt{3}$

35. 3200; 6400.

36. 924.34, or 925 m.p.h.

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*Values are given in the order: sin, cos, tan.

Pages 295-297

1. AC; OC; FG; OD; OG.

2. I and II; I and III; I and IV.

3. sine and cosecant; tangent and cotangent; cosine and secant.

4. See table on p. 164 of the text.

5. sine and cosine.

6. secant and cosecant.

7. tangent and cotangent.

8. sine and cosine.

12. period = π; amplitude = 1.

13. period = 2π; amplitude = 2.

14. period = $\frac{\pi}{2}$; amplitude = 2.

15. period = $\frac{\pi}{3}$; amplitude = ∞.

24. $\theta = 0°; 60°; 180°; 300°$.

25. $x = 270°$.

26. $\theta = 0°, 90°, 270°$.

27. $x = 0°$.

28. $\alpha = 0°, 180°$.

29. $\theta = 30°, 150°, 210°, 330°$.

30. $x = 45°, 90°, 225°, 270°$.

36. $x = 22°30', 67°30', 112°30', 157°30', 202°30', 247°30', 292°30', 337°30'$.

37. $x = 90°, 270°$.

38. $x = 0°$.

39. $\theta = 0°, 30°, 90°, 150°, 180°, 210°, 270°, 330°, 360°$.

40. $\phi = 0°, 180°$.

Pages 297-300

1-12. True: 1, 2, 4, 6, 7, 9, 11, 12.
False: 3, 5, 8, 10.

13. a and b. $A + B + C = 180°$ and $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

c. $\frac{a - b}{a + b} = \frac{\frac{1}{2}\tan (A - B)}{\frac{1}{2}\tan (A + B)}$ and $\frac{a}{\sin A} = \frac{c}{\sin C}$

d. $s = \frac{a+b+c}{2}$, $r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}$, and $\tan \frac{1}{2}A = \frac{r}{s-a}$.

14. When large figures are involved and computation with logarithms is therefore desirable.

15. a. See p. 220. b. See p. 232. c. See p. 235. d. See p. 238.

16. See p. 222.
17. 1377.6, or 1378.
18. .1479
19. 89.397, or 89.4 m.p.h.
20. 957.82, or 957.8 ft.
21. 40,906, or 40,910 sq.units
22. 106,660, or 107,000 sq.units
23. 111.32, or 111.3 sq.in.
24. R = OA = 107.47, or 107.5
25. r = 33.836, or 34
26. BAO = 18°21'7", or 18°

27. A = 28°57'20", or 28°57'. C = 104°28'42", or 104°29'.
B = 46°34'6", or 46°34'.
28. B = 27°19'41"; C = 52°22'45"; a = 3029.9.
29. A = 79°45'25"; C = 58°42'15"; a = 4776.7;
A' = 17°9'55"; C' = 121°17'45"; a' = 1432.6
30. 723.27, or 723 nautical miles.
31. 138°6'18", or 138°; 296.9, or 297 m.p.h.
32. 121.49, or 120 lb.
33. 218.48, or 218 m.p.h. north; 416.14, or 416 m.p.h. east.
34. 205°17'33", or 205°.
35. AC = 1558.5, or 1600 yd.; BC = 1097.1, or 1100 yd.
36. 56 yards.
37. 49.8, or 50 yd.

Page 300. See p. 49 of this pamphlet.

Page 310

1. a = 28°56'
b = 57°10'
c = 61°40'

2. A = 47°32'
B = 62°32'
c = 61°35'

3. A = 67°12'
b = 8°1'
c = 19°59'

4. A = 43°26'
B = 72°31'
b = 64°5'

5. A = 78°38'
B = 129°10'
c = 99°26'

6. A = 73°21'
a = 45°35'
b = 17°46'

7. A = 114°54'
B = 50°45'
a = 122°57'

8. B = 66°46'
a = 47°59'
b = 59°58'

9. B = 60°25'30"
a = 155°10'0"
c = 136°50'37"

10. A = 120°40'6", or 120°40'10"
B = 55°36'20"
c = 113°58'21", or 113°58'20"

11. a. 111°10'22", or 111°10'20"
b. 121°49'57", or 121°49'55"
c. 79°1'15"

12. B = 95°1'
a = 51°58'14", or 51°58'
c = 93°54'

13-1. a = 5.0499, or 5.05 ft.
b = 9.9774, or 9.98 ft.
c = 10.7629, or 10.8 ft.

13-2. a = 7.0599, or 7.060 ft.
b = 8.9535, or 8.953 ft.
c = 10.748, or 10.75 ft.

13-3. a = 3.2056, or 3.206 ft.
b = 1.3992, or 1.399 ft.
c = 3.4877, or 3.487 ft.

13-4. a = 7.0540, or 7.054 ft.
b = 11.1846, or 11.18 ft.
c = 12.3162, or 12.32 ft.

13-5. a = 13.1366, or 13.14 ft.
b = 22.7068, or 22.71 ft.
c = 17.3545, or 17.35 ft.

13-6. a = 7.9558, or 7.956 ft.
b = 3.1009, or 3.101 ft.
c = 8.4125, or 8.412 ft.

13-7. a = 21.4589, or 21.46 ft.
b = 7.9849, or 7.985 ft.
c = 19.6001, or 19.60 ft.

13-8. a = 8.3746, or 8.375 ft.
b = 10.4661, or 10.47 ft.
c = 12.2930, or 12.29 ft.

14-1. 40.213, or 40.2 sq.ft.

14-2. 50.441, or 50.44 sq.ft.

14-3. 3.3489, or 3.349 sq.ft.

14-4. 65.220, or 65.22 sq.ft.

14-5. 296.07, or 296.1 sq.ft.

14-6. 18.893, or 18.89 sq.ft.

14-7. 190.13, or 190.1 sq.ft.

14-8. 72.445, or 72.44 sq.ft.

15. a. The first rule of species states that an angle and its opposite side are in the same quadrant.

b. The sum of the angles of a spherical triangle are greater than 180°.

c. Each side of a spherical triangle is less than the sum of the other two sides.

d. The sum of the sides of a spherical triangle is less than 360°.

e. The second rule of species states that if any two sides are in the same quadrant, the third side will be in the first quadrant.

f. This violates the first rule of species.

Page 312 (top)

1. B = 72°47'; b = 52°38'; c = 56°18'.
   B' = 107°13'; b' = 127°22'; c' = 123°42'.

2. B = 38°7'; b = 36°44'; c = 75°42'.
   B' = 141°53'; b' = 143°16'; c' = 104°18'.

3. A = 29°48'11"; a = 29°17'23"; c = 79°51'0".
   A' = 150°11'49"; a' = 150°42'37"; c' = 100°9'0".

4. B = 27°45'42"; b = 23°2'40"; c = 122°49'15".
   B' = 152°14'18"; b' = 156°57'20"; c' = 57°10'45".

5. B = 45°22'; b = 36°46'; c = 123°22'.
   B' = 134°38'; b' = 143°14'; c' = 56°38'.

6. A = 37°19'; a = 31°8'; c = 121°28'.
   A' = 142°41'; a' = 148°52'; c' = 58°32'.

Page 312 (foot)

1. AC = BC = 82°54'; AB = 108°46'.
2. AB = BC = 75°10'; B = 102°56'.
3. A = 156°28'; AB = 82°12'; BC = 151°48'.
4. A = B = C = 75°34'.
5. A = B = 87°21'16"; C = 42°43'.
6. B = 57°19'20"; C = 129°19'24"; AB = 118°50'16".
7. A = B = 114°44'34"; AB = 79°11'44".
8. AB = BC = AC = 109°31'47".

Page 314

1. B = 11°24'; C = 33°5'; a = 108°2'.
2. A = 15°47'; C = 133°56'; b = 74°12'.
3. A = 47°15'; B = 57°23'; C = 111°27'.
4. C = 93°46'; a = 124°14'; b = 95°30'.
5. A = 31°59'8"; B = 121°54'49"; C = 63°21'24".
6. A = 142°7'34"; C = 103°8'0"; a = 140°55'12".
   and A = 37°52'26"; C = 76°52'0"; a = 39°4'48".

7-1. 33.22 ft.

7-2. 34.142, or 34.14 sq.ft.

7-3. 90.686, or 90.69 sq.ft.

7-4. 338.92, or 338.9 sq.ft.

Page 320

1. A = 41°34'; B = 39°26'; C = 127°8'.
2. A = 116°53'; B = 31°30'; C = 70°44'.
3. A = 51°38'; B = 73°28'; C = 125°20'
4. A = 46°27'; B = 50°16'; C = 137°30'.
5. A = 60°44'; B = 50°28'; C = 120°0'.
6. A = 95°7'; B = 83°36'; C = 103°52'.

Page 321

1. a = 135°56'; b = 121°26'; c = 64°45'.
2. a = 48°4'; b = 58°6'; c = 39°38'.
3. a = 64°5'; b = 47°21'; c = 96°33'.
4. a = 113°18'; b = 129°57'; c = 62°16'.
5. a = 130°7'; b = 96°59'; c = 53°3'.
6. a = 93°46'; b = 88°8'; c = 39°11'.

Page 323 (top)

1. A = 122°30'; B = 94°7'; c = 99°33'.
2. B = 120°29'; C = 45°8'; a = 60°4'.
3. A = 65°30'; C = 136°42'; b = 96°41'.
4. A = 69°14'; B = 82°16'; c = 26°36'.
5. A = 58°52'; B = 124°47'; c = 56°48'.
6. B = 115°52'; C = 37°54'; a = 48°11'.

Page 323 (center)

1. C = 31°40'; a = 46°34'; b = 71°7'.
2. C = 126°41'; a = 125°12'; b = 81°41'.
3. A = 59°15'; b = 88°15'; c = 66°57'.
4. A = 32°51'; b = 72°12'; c = 40°45'.
5. B = 85°36'; a = 47°8'; c = 32°28!.
6. B = 99°48'; a = 151°50'; c = 44°12'.

Page 326

1. B = 24°3'; C = 98°55'; c = 49°40'.
2. No solution.
3. No solution.
4. A = 101°10'; a = 144°44'; c = 34°5'.
   A' = 138°47'; a' = 22°49'; c' = 145°55'.

5. B = 7°42'; C = 33°31'; b = 8°52'.
   B' = 129°0'; C' = 146°29'; b' = 63°36'.
6. No solution.
7. A = 36°14'; a = 39°57'; c = 51°28'.
8. C = 70°13'; a = 37°45'; c = 51°37'.

Page 327

1. 253.07, or 250 sq.ft.
2. 2054.9, or 2050 sq.ft.
3. 1827.1, or 1830 sq.ft.
4. 110.46, or 110 sq.ft.
5. 1569.9, or 1570 sq.ft.
6. 4425.3, or 4430 sq.ft.
7. 19,353, or 19,350 sq.ft.
8. 3085.2, or 3085 sq.ft.
9. 691.15, or 691.2 sq.ft.

Pages 332-333

1. 4676 nautical miles.
2. 2083 nautical miles; 54°24'.
3. 2756 nautical miles; 72°53' is the bearing of Lisbon from Boston; 295°12' is the bearing of Boston from Lisbon.
4. 3564 nautical miles; 318°48'.
5. 3003 nautical miles; 251°37'.
6. 1347 nautical miles; 275°16'.
7. 3589 nautical miles.
8. 4072 nautical miles.
9. 7354 nautical miles; 194°19'.
10. a. 5002 nautical miles; 154°16'. b. 2312 nautical miles; 155°26'E. c. 159°20'.
11. 47°15'N; 65°23'W.
12. 214°27'.
13. 39°33'N: 98°32'W.

Page 300

1. 60°, 300°. 2. $-1 + 3i$. 3. $2\sqrt{5}$ cis 26°34'.
4. $\sqrt{26}$ cis (-11°19'), or 5.000 - i. 5. 35°16'.
6. $x = \frac{1}{2}$. 7. 2, $-1 \pm i\sqrt{3}$. 8. $r(\cos\theta + i\sin\theta) = re^{i\theta}$.
9. $e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$. 10. $x^3 - 4x^2 + 4x - 3 = 0$.

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